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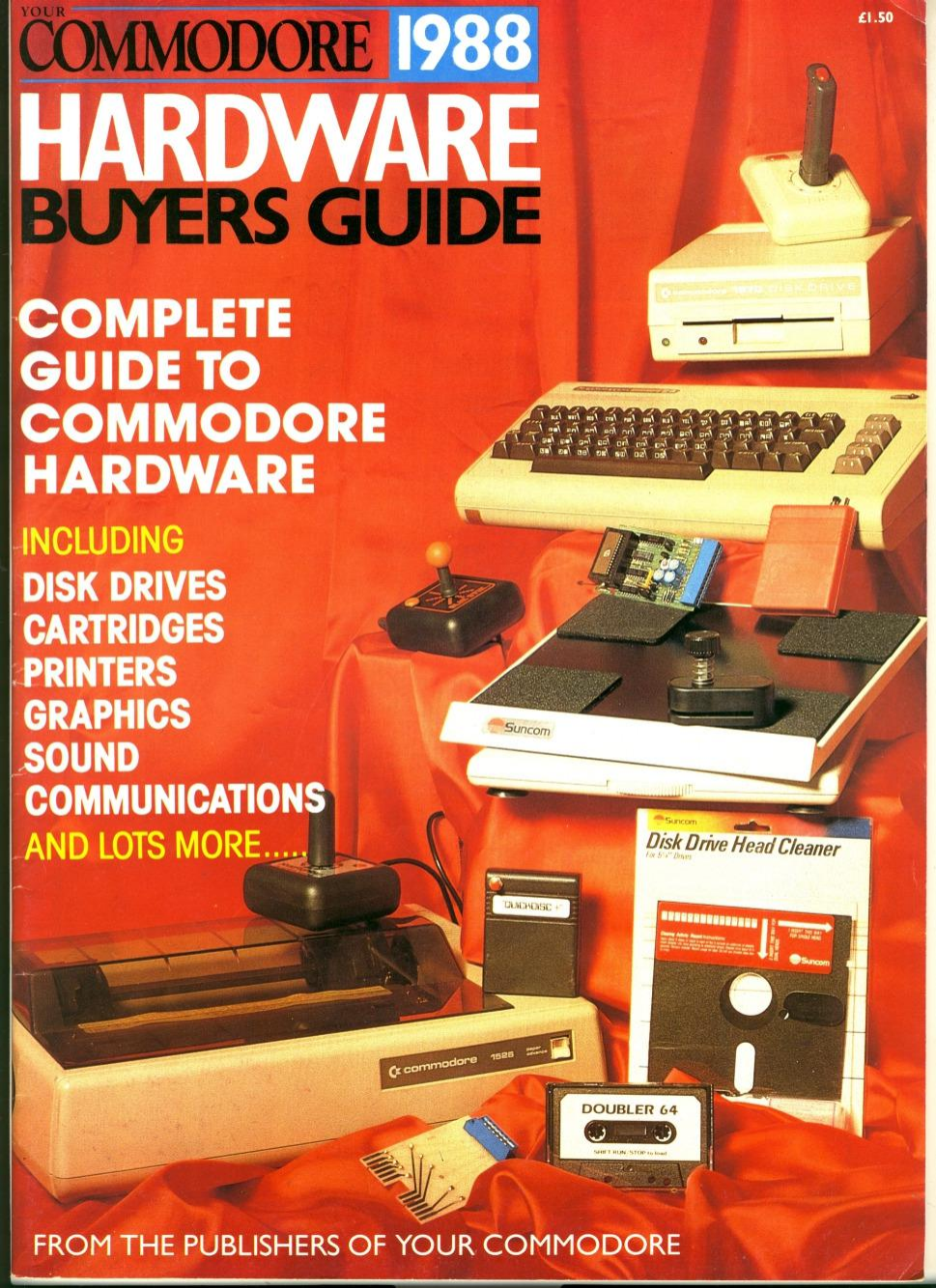

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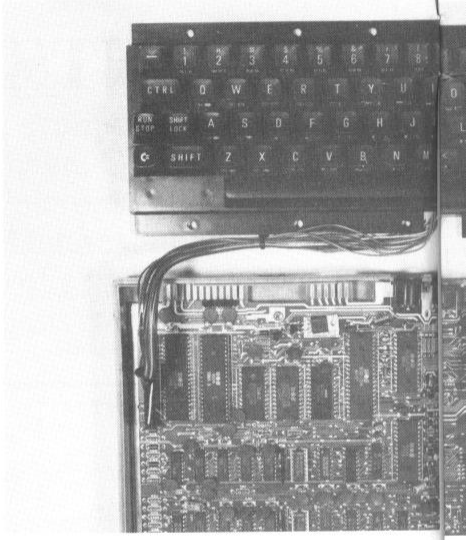
The Commodore

Few computers can approach the success that the C64 has enjoyed. Why has is it remained so successful for so long?

by Norman Doyle



The Commodore 64 is the flagship of CBM and has maintained a high profile in the market since it was first launched in August 1982. Despite the better sales performance of the Sinclair Spectrum (now under Amstrad's wing), the C64 is a far superior machine with a 40 column, 16 colour display, provision for eight sprites and probably the best sound chip in any home computer.

Really, I should refer to the C64 by the name of its latest incarnation, the 64C, because the production line in Germany has been turned over to the production of this handsome restyling. However, the C64 by any other name still smells as sweet.

In the early days most of the programs written for the C64 were upgrades from earlier VIC 20 programs. With the passage of time more and more programming tricks have been exploited, graphic designers have gone to town with animation effects and a new breed of musician has appeared to transform the sound chip into a voice simulator one minute and a high class synthesiser the next. For the most part, the net result is that games today bear little resemblance to their predecessors and this has had a knock on effect to serious software.

What do the programmers play with?

There are essentially four modes of operation for the screen display:

Normal text mode.

This is the power up mode which only allows three colours to be used simultaneously. The screen comprises 40 columns by 25 rows giving a total of 1000 character squares on the screen. Each character square comprises of an eight by eight pixel matrix and all characters can be redefined.

The three colours are border, background and foreground (character). All sixteen colours can be used on one screen but each character square can only exhibit two of these colours: background and foreground.

Multicolour text mode

A few deft pokes and the character square can exhibit a total of four colours, including the background colour. This is subject to the swings and roundabouts syndrome, what you gain in colourfulness you lose in horizontal resolution. Each multicolour character square is formed by a matrix of four by eight pixels.

Once again the character set is redefinable and this mode has been heavily exploited by games programmers.

Hi-res mode

This is the Commodore's graphics mode giving a screen resolution of 320 by 200 pixels. This is similar to the normal text mode and frees the user from fixed character positions allowing hi-res pictures to be drawn.

Hi-res multicolour mode

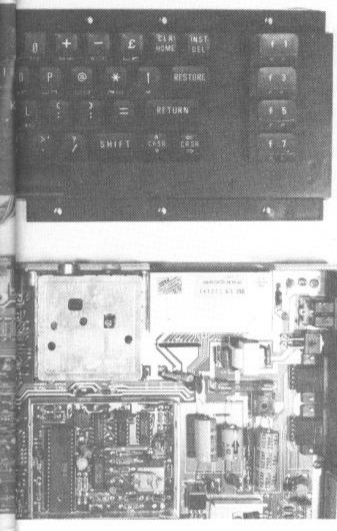
Once again this mode gives a blockier appearance because the horizontal resolution is halved to 160 pixels.

In addition to these modes there is the extended colour mode which splits the character set into groups which can have differently coloured backgrounds. Because of the subsequent reduction to only 64 characters in the set, it limits what can effectively be done but some nice effects can result.

In addition to these displays there is provision for a maximum of eight sprites to be displayed at the same time. Each sprite can be switched to normal or multicolour mode independently of one another and totally free from the screen mode selection.

The advantage of sprites is that they don't have a transparent background colour. This gives them an appearance as though they were painted on a transparent sheet and anything they pass

64



over can be seen through the spaces between the sprite design. They are moved independently of the screen and are an absolute boon to game writers.

For the benefit of programmers the screen can be relocated to any part of the 64s memory. This means that two or more screens can be used at once to allow special effects by switching from one to another in quick succession.

The sprite limitation can also be overcome by expert programmers using split screen techniques.

Sound Technology

The audio capabilities of the C64 are provided by the SID (Sound Interface Device) chip which gives three independent sound channels. With each channel you get full ADSR envelope shaping and a choice of three waveforms or white noise plus limited ring modulation, filtering and resonance.

This means that three part harmonies are easily achievable but careful programming can make this seem like a small group. The sound from a well tempered C64 can beat many synthesisers for range and colour.

Peripherals abound for the C64 and every orifice can spew cable to a wide assortment of printer interfaces, cartridges, modems, disk drives and a host of other add-ons. Ranged along the back from left to right you'll find a cartridge socket, TV output, composite monitor socket, serial port, cassette interface and an RS232–type user port. These are supplemented by two ports for joysticks, paddles, graphics pads, light pens, track balls or mouses (mice?).

Internally the whole juggling act is held together by a 6510 microprocessor which is essentially a modified 6502. When it is not accessed directly through a machine code program it is driven by the Basic ROM containing the necessary coding to execute Basic V2.

After much had been made about the 64K RAM, it came as a great disappointment and source of confusion to early buyers when the power up screen declared only 38K of Basic RAM. Far from being a commercial con trick there *is* 64K of RAM, all of which is available to the user but at the cost of the full operating system.

Parts of the memory are overlaid by the OS chips in a piggyback fashion which means that access can only be gained to the extra RAM by bank selection. This has been exploited to the full by commercial machine code programmers, vastly improving the quality of software.

The real Achilles heel of the system is the Basic implementation which is archaic and contains no direct commands for sound or graphics control. The bad news is that this makes sophisticated programming a pig but the good news is that all the PEEKs and POKEs form a good introduction to machine coding and there are not so many Basic keywords and structures to memorise!

The apocryphal story of C64 Basic is that Commodore commissioned a fully comprehensive implementation but it didn't see the light of day. Instead we got Simon's Basic in the form of a plug-in cartridge at extra cost. David Simon was only 16 years old when he devised the program with its 114 extra commands and, despite the desirability of a comprehensive Basic, it never really set the C64 world on fire.

Other companies have produced add-on Basics and the apparent weakness of the 64 can be turned into a strength because the machine can be converted into a dedicated computer with the correct handling routines.

Another area of criticism has centred around the slow operation of cassette and disk loading. Much has been done in software modification to overcome the deficiencies of the loading systems and users often wonder why the operating system didn't do this in the first place. There are two answers to this question. Commodore claim that the slow load is more reliable and it certainly does appear to have a higher success rate than most fast loaders. The second and more plausible reason is that Commodore just didn't realise what could be achieved!

On the outside the machine doesn't seem to have changed at all prior to the 64C redesign but internal changes have been going on all of the time and the latest version of the component board is the slickest yet.

In computer history there has never been a machine to equal the Commodore 64 in popularity, price and style. If this model doesn't see its tenth birthday I'll hang up my pen and inkpot for good!

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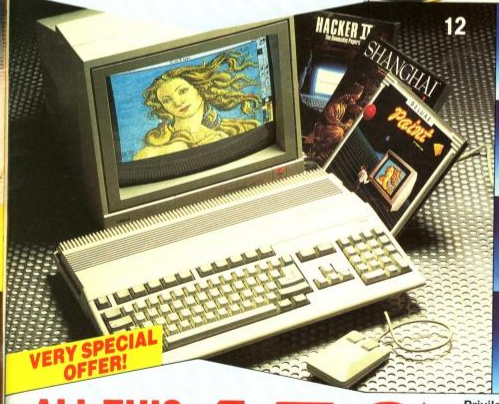

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Art Gallery

Mice, pens and joysticks are useless without the software to drive them.

by Norman Doyle

It's difficult to know how to start choosing a graphics package. The range seems so bewildering. The starting point should be the facilities on offer but, though most people know what they want from a graphics package, few people know what they really need.

For the best results the package should use the multicolour, bit-mapped mode. Although this does impose a halving of the horizontal resolution, the benefits gained in colour use mean that highly polished results can be achieved.

A pixel (picture cell) is the smallest element, or building block, from which the image is created and the resolution is the number of pixels which make up the total image. The rule is therefore, the greater the number of pixels, the higher the resolution.

On a normal screen there is a matrix measuring 40 columns by 25 lines. Each matrix square consists of a block which is eight pixels square giving a screen size of 320 pixels wide by 200 pixels high. This degree of resolution would permit a highly detailed image to be produced but hardware restrictions imposed by the system means that colour use is strictly limited. Using the multicolour mode permits all the colours to be used but reduces the horizontal resolution from 320 to 160 pixels.

Another imposed problem is that colour flexibility is impeded by the limits of only having three ink colours in each cell measuring 4x8 pixels.

A good graphics package will have an on-screen menu so that you can always see your picture when selecting the next drawing option. This may seem like a problem because part of the screen is obscured by the menu but most menus can be moved around the screen or even switched off to display the full image.

The main consideration is, of course, the contents of the menu. Facilities must be made for loading and saving images; for changing printer parameters to tailor the output to suit the printer and interface that you are using; and an *Undo* option, which erases your last action, is better than having to rely on *Erase* for correcting mistakes which may occur when you're completing a complex image. A full range of drawing options should allow freehand drawing and a wide range of shape creators such as elastic line drawing, polygon, circle and elipse functions, and triangles, squares and rays are also useful facilities. Brush size selection and colour fill are also essential and the ability to add text to the image can ease the problems of creating letters pixel by pixel.

Desirable though not absolutely essential are facilities for creating texture patterns for the *Fill* option, and for designing brush textures. A *Zoom* option is also offered by some packages which is ideal for adding complex details. Zoom allows the selection of an area of the screen, which is then blown up to show the pixels in greater detail. Apart from relieving eyestrain, this facility is essential if you are using a lightpen unless you

have a very steady hand!

Finally, there has to be a pallette from which the brush colours can be selected.

Cadmaster

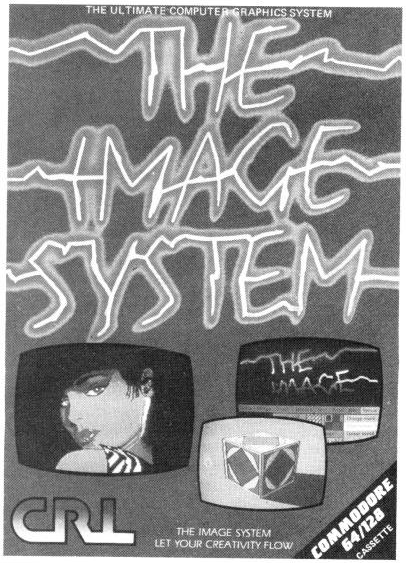
Trojan offer a free lightpen with each of their three versions of this package for the C64, Plus4 and C16. It has a wide range of facilities allowing five pen thicknesses and three quill sizes which can be used in freehand, line, circle, triangle, ray and box modes.

Taking into account special fill functions, active banding and wash facilities, and the price of just £19.95, it would be reasonable to say that the lightpen is a free offer and that Trojan are offering a bargain to anyone who needs a quality graphics package but has reservations about using a lightpen.

The Image System

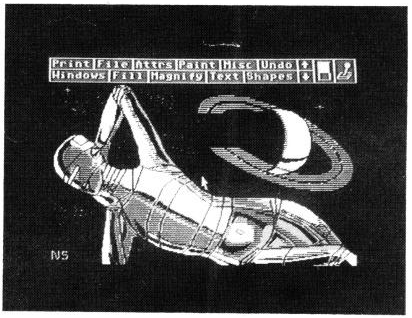
In the fight for the ultimate graphics package, **CRL** are offering a heavyweight package which they use to create many of the hi-res loading screens featured in their games. The on-screen menu display has a panel which displays a blow up of the current working area to help with adding the fine detail.

Where this package really scores is in the area of screen manipulation. While the screen is being created, areas can be moved, copied, taken up and down in scale, rotated and even folded to create 3D effects.



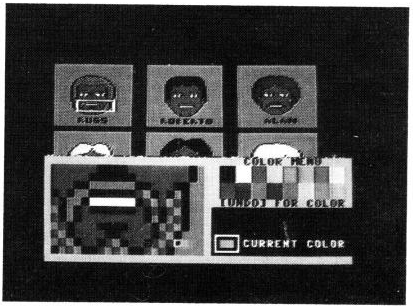
The Advanced OCP Art Studio

Although the £24.95 price tag may seem a little high, this package is worth every penny. It contains facilities which would normally be associated with Electronic Art's excellent Deluxe Paint graphics package for the Amiga, which is no mean trick on the C64!



It has all the expected facilities for creating images, including an excellent Zoom facility which allows the user to select the degree of enlargement. What really sets it apart is the ability to create and save picture elements, shapes which may be saved and loaded for use in later projects.

The image can be created using either a joystick or a mouse. **Rainbird Software** have also included the facility to display the Zoomed image alongside the actual normal resolution picture so that you can see the micro effect of your macro changes.



Blazing Paddles

This is the package which **Datel** are championing and they will supply it with a matching lightpen if you wish, though it also supports graphic tablets, mice and joysticks.

The main menu is displayed around the four edges of the screen. From this the many functions can be selected including a pattern fill and cut'n'paste. This last facility enables the loading of special, pre–designed characters which are provided as part of the package. Animals, vehicles, various shapes and facial features can all be used to create pictures, making this a fun package for young children as well as adults.

Blazing Paddles costs £12.99, or £24.99 with the lightpen.

Cadpack

If you require an art program tailored towards making technical drawings, where dimensions and scaling are of great importance, then **Abacus Software** have the answer. ***Cadpak*** is an extremely flexible program which has 22 functions on the main menu, each leading to many further functions. Drawings, layouts and renderings are easily produced using the keyboard or a lightpen.

For the architect the ability to save often used devices and shapes should prove a boon. The scaling and dimensioning facilities are particularly impressive, as you would expect from a package costing £24.95 on the C64 or £34.95 in 128. The optional lightpen adds an extra £12.95 to the cost.

Artist 64

This package supports joystick or mouse operation and has to be seen to be believed. Although it is easy to operate, the permutations and combinations of functions seem almost limitless. Admittedly it's one of the most expensive packages on the market but it's also a highly polished vehicle for the artist.

Wigmore are justifiably proud of their art package which is impossible to describe in the limited space available here. To give you a taste of the range, images can be copied to any area of the screen, cycled through various colours, magnified, drawn from a fixed locus with a brush of your own choosing and design, texture filled, flipped, mirrored, screens may be partially cleared and so the list goes on and on.

Ultrabasic 64

Along with its sister program, ***Videobasic–64***, this shows a different approach to graphics on the Commodore. It's a LOGO-like language but **Abacus Software's** form of Turtle graphics is far faster and can easily be linked in to Basic programs. Apart from permitting the use of hi-res graphics, there are also limited sound controls and a sprite designer.

3D Graphics Drawing Board

Yet another approach to graphic art is provided by **Glentop Publishers**. As the name suggests, this produces images which can be twisted and turned this way and that to give a true 3D feel.

The images are wire frame graphics produced from three basic shapes: a cube, a pyramid and a cylinder. From these core shapes other shapes can be created including spheres. When the finished object is rotated, you can opt for showing or hiding hidden lines for clarity.

As an introduction to Computer Aided Design principles, this is an ideal package at a relatively low cost, £14.95.

Vidcom 64

The arrival of *The Image System* eclipsed **CRL**'s earlier graphic pack, ***Vidcom 64***. The strength of which was the bargain price of only £4.95. If CRL have any left or if your retailer has, buy it immediately!

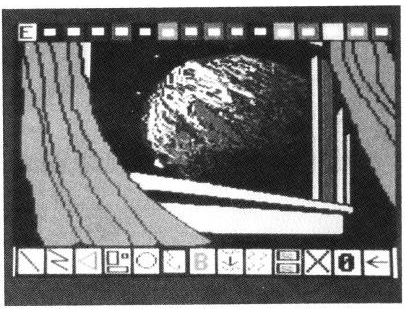
The package allows two modes of operation; multicolour or standard bit-map. With multicolour you get the halving of the horizontal resolution but up to four colours within a character area. In standard bit-map mode the horizontal resolution is high but the character squares are limited to only two colours.

As the forerunner to The Image System, Vidcom has many advanced features such as pattern fill, area copying and reversing out of selected screen areas.

The problem will not be using this program for your graphic designs, it will be finding a copy that hasn't been snapped up yet.

Picasso's Revenge

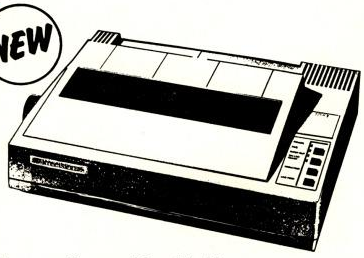
This is the program which accompanies **Precision**'s lightpen. It is an honest, workmanlike program which gives you all the tools you need but doesn't go overboard on special facilities. For the beginner, this approach means that getting the full benefit from a lightpen driven program will not mean hours of reading and experimentation before you're able to tackle your first major artwork.



Drawing To A Close

If I was asked to place my hand on my heart and recommend the best computer graphics program, I think it would easily be Wigmore's Artist 64. Apart from a good art program, you also get little touches like being able to record your movements so that you can replay the creation of your image at a later date.

Precision for Performance



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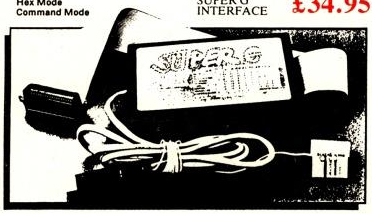

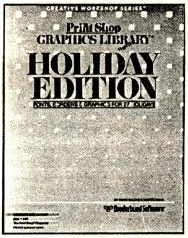

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A Printer Buyer's Guide

Buying a printer immerses the novice in a sea of jargon. Here's your first swimming lesson!

by Jon Vogler

A printer can cost more than your computer and yet most people still think of them as the noisy part of a typewriter. Far from just being a platten and a print head, the modern printer is an intelligent device which can offer a range of options to the user. Not all machines offer the same facilities and the pitfalls are numerous.

Prices

You'll usually be able to buy printers at lower prices than the 'recommended retail prices' quoted by the manufacturer. Work on the assumption that the best printers will be available for at least 10% below their RRPs and the older, not-so-hot ones at 20% lower. Shop around for the best discounts you can get and remember that RRPs include VAT but not the cost of the data cables and plugs.

Warranty

Most models offer a 12 month warranty (Citizen give two years). You'd be advised to get a written statement from the dealer underwriting your rights even if it's just a scribbled note on the back of your receipt.

If you opt for mail-order, which is often cheaper, check who pays the carriage costs if the printer fails and has to be sent for repair. It will probably be your responsibility and makes buying nearer home a better prospect.

Speeds

Various suppliers have criticised my printer speed tests, which show print speeds to be far lower than the manufacturers' claims. So why not run your own test on the printer you plan to buy? Set it running on a slab of text some 5000 characters long and then time it with a watch. Remember to terminate the test timing when the *printer* actually finishes rather than when the computer finishes outputting characters. This is because most printers now have memory buffers which thankfully reduce the time that the computer is occupied but mask the actual speed.

When you're finished you'll have a far better idea of how long the machine will take to print the kind of things you're likely to write. The manufacturers' figures usually tell you how quickly the machine will print a straight line of spaces: a singularly useless and deceptive piece of information in my opinion.

Fig 1: Optional print styles on the Star printer

Memory Buffers

An input buffer is RAM memory built into the printer itself to stockpile incoming characters from the computer. This effectively speeds-up printing because the computer can output characters far faster than the printer can print them. Using a buffer as a collecting pen means that the computer can spew out its information at high speed while the printer works at its own rate. This releases the computer from printer output far more quickly and the user can move onto other things while the printer chugs along at its own speed.

Buffers are now becoming so common and so large (often with an option on size) that by taking account of them, printing speeds would appear very inaccurate. A document of 3000 or 5000 characters respectively would take two or four minutes to print out on a 20 characters per second daisywheel. With a buffer of three or five kilobytes, the transfer is comparatively instantaneous and you can save all that time on almost every printout. So, if your main concern is to find a printer that doesn't tie your computer up for a long period, look for one that combines high-draft speed with a large'input memory buffer' or buy a buffer as a seperate unit.

How Matrix Printers Work

Most printers, apart from the very expensive ones, are dot-matrix or daisywheel types. Dot-matrix is based on a system of pins and hammers. The 'print head' usually has just a single vertical line of nine pins, but sometimes it is a rectangle containing more. Each pin is hit by a hammer causing it to strike the ribbon and produce a single dot on the paper. A single pin may be knocked four or five times to make one character: for example, the top pin may be hit five times to make the cross-bar of a 'T'.

In theory, the more pins in the head, the better the quality of the print; 24-pin printers are becoming more common but normally cost over £500. Watch out for price cuts, though, as they try to compete with the falling prices of laser printers.

Interfaces and Compatibility

Printers come with one of two kinds of connection to the computer: serial and parallel. A parallel interface means that the eight bits (binary signals) needed to make one byte (single character) travel side by side down eight strands of a ribbon cable. This means that the computer receives each byte in turn, whereas the slower serial interface sends each bit down the same wire in bursts of eight, acting rather like a commissionaire at the January sales. It's easy to see that this means that the parallel interface can be eight times or more faster than serial connection.

Sometimes one or other is offered as standard and the other as an option for which you will have to pay extra; some printers have cartridge interfaces built-in.

Some printers work on the coding system adopted by IBM. However, most dot-matrix printers are Epson-compatible. This compatibility is limited now because it was based on the Epson FX and MX series printers, both of which have now been superceded.

These models couldn't do near letter-quality (NLQ) type so printer manufacturers have chosen their own codes to select this mode. Though it looked like the Epson standard was being adopted at one time, it is high time the computer industry set up a new standard between themselves.

To be on the safe side, select a computer with italic, bold,

elite (compressed) and NLQ typefaces and buy a wordprocessor which will allow parameters to be set up to access them.

Extra Character Sets

In many machines, the print buffer memory spacecan be used to hold different sets of characters; either those for other languages, such as the accented French alphabet, or user defined sets. These are often called downloadable characters and are particularly important for those users who need to printout mathematical and scientific equations and symbols. Check how many different language character sets each prospective machine has and, if you need to use one in particular on a regular basis, check that all the required characters are there.

Controls and Software

A control panel should have switches for mains on/off, going on–line and for form and line feeds. Form feeds are used with fanfold paper when you wish to set the print head at the top of the next sheet of paper and line feeds only advance the paper one line at a time.

As more printing modes become available, the manufacturers have realised that many users, and some wordprocessors, cannot cope with so many software controls. In the past some of these functions were selectable through the use of banks of four, eight or ten DIP switches. These are used to permanently set the printer into particular modes such as NLQ, auto linefeed or to select specific character sets and so on. The tiny switches have never been popular, frequently requiring the dismantling of part of the printer before they can be delicately manipulated with the point of a ballpoint pen.

A prospective buyer should consider how easily the DIP switches can be changed, because situations often arise when the current switch configuration is not really suited to the circumstances. Sometimes the paper which you normally feed through the machine is not available, for example, and a flick of a switch is preferable to reconfiguring your word processor or sending out control codes every time you want to print something out.

The latest breed of printers now include front control panels which allow the user to select special modes. Normally these are reserved for the range of typefaces currently available and their use often requires the pressing of various combinations of switches to be pressed and it may prove not to be as user friendly as you'd thought.

Fonts, Faces, Modes and Pitches

The increasing complexity of printers and the rising use of desktop publishing systems has meant that the jargon used by printers is being used by a wider range of people. Terms such as fonts, founts, faces and modes are thrown tossed back and forth enough to make a novice's head spin.

A font is a family of letter shapes (British printers often refer to this as a fount). They revel in fanciful names such as Baskerville, Helvetica, Pica and Times.

Within each font you can have variations on the theme known as faces. Face is short for typeface and printer users soon become familiar with terms such as *italic* (sometimes called oblique), Roman, **bold** or ***bold italic***.

Within each face you can get further variations known as modes. In printerspeak these are specifically called condensed, expanded, subscript and superscript and all of these can be combined to give dazzling descriptions such as 'expanded italic subscripts'!

Condensed type is very handy if you're trying to squeeze in as much type as possible into a small space such as a label or a table of data. This mode shortens the letter horizontally while maintaining the same height, as though the letter was breathing in. *Expanded* type is the opposite of condensed and delivers letters which are stretched out horizontally but maintain the standard height.

Pitch is a measure of of the number of characters per inch (cpi). Modern laser and ink jet printers offer a variety of pitches on all fonts but dot matrix and daisywheel machines normally have a specific pitch for a particular font though you do occasionally get up to three different pitches for the standard roman characters.

Pitches are given names like pica and elite. Pica (the standard pitch) typically offers 10 cpi whereas the narrower elite pitch has 12 cpi.

Fonts and faces are increasing in number as printers and interfaces become more sophisticated. A typical range, produced on a Star SG–10 printer is shown in Fig 2.

More Modes

Extra modes which may be available to the user include NLQ, bold, emphasised and double strike. These are all variations on the standard 'dotty' *draft* mode and describe the way that the dots are arranged on the paper.

Emphasised and bold are two names for the same effect. After the normal draft character has been printed, the head moves a tiny bit to the right and prints again so that the horizontal lines of the character consist of two sets of dots which touch forming an almost solid line and the vertical components of the letters are double thickness.

Double strike, on the other hand, is when the printer head prints a draft character and then the head moves fractionally down and repeats the character. This means that the horizontal lines are twice as thick but still dotty and the vertical lines are almost continuous.

NLQ or High density characters are produced in a similar way but the second dot positions are more accurately placed so that the line *is* continuous. On some printers NLQ is a combination of double strike and emphasised. In NLQ mode italics and bold may not be available.

Facing Up To It All

In such a jungle, what do you need on the control panel and what should be left as software controlled?

In general, you need NLQ, condensed and expanded characters along with other typefaces such as Pica, Courier or Letter Gothic. This is because once they have been selected they

will not be changed for the rest of the document. Italic, bold, super– and sub–scripts are 'spot effects' and are best turned on and off where needed through software controls.

Proportional spacing is also desirable as a panel switch. Most printers support this facility which tidies up the look of a document by closing up the spaces between thin letters such as 'i' and 'l' and the neighbouring letters.

There should also be a form feed and a linefeed button to help align paper and an offline toggle to kill the printer without clearing the internal buffer.

Light Relief

All printers should have LEDs (those small coloured lights) to indicate that they are plugged in and turned on, that they are also on line and to indicate when the paper supply has run out (though an audio signal is just as useful). Extra lights to indicate the mode of printing are also desirable.

Fanfold or tractor feed paper is pulled or pushed through the printer by a *tractor* which is a cog on each side of the paper whose sprockets fit into the tear–off hole strips down each side of the paper. Sheet paper is fed through by being gripped between the platten and a roller in the same way as on a typewriter.

Just as you can't feed sheet paper through the tractor drive, it is inadvisable to try to feed fanfold paper through on friction drive. As the printout continues the slight reverse pull, from the weight of paper being drawn off the stack, will cause the paper to 'wander' out of alignment.

When buying a printer make sure that the cost includes a tractor feed mechanism. Some models only supply them as optional extras. Also choose your paper carefully because some fanfold paper has badly or unperforated edges. Unless you wish to keep the perforations attached check the quality before buying.

Many machines offer optional cut–sheet feeders but the cheaper ones never work very well. If you anticipate using a lot of headed paper for business letters then insist on a sheet feeder demonstration before you buy.

Ribbon Replacements

Most ribbons come in cassette form and either travel with the head or stretch the full width of the paper and allow the head to pass back and forth. There's no difference in performance but the shorter, travelling type are easier to load without getting your fingers black.

In both cases, loading a new ribbon is rarely fraught with danger. With most printers you simply place the cassette in place wind the tensioning knob and the ribbon falls into place on the head between the hammer face and the paper–shield which prevents ink from scratching off the ribbon and smudging the text.

Some printers use multistrike carbon ribbon which is a compromise between the old, ink–impregnated, cloth strip type (the ones which gave 'ribbons' their name) and the single strike ribbons which are acetate based and ensure total transfer of the ink onto the paper, giving sharp–edged, dense printouts.

Print Quality

The most important criterion is the appearance of the final printout, particularly the standard of the NLQ.Judge the characters not according to your present needs but against what you may require in the coming years. Are the characters pleasing to the eye, clean edged and unambiguous? Do the 'descenders' of the 'y';'j';'p';'q' and 'g' truly descend? Owners of older Commodore printers will appreciate how difficult and cheap these letters can appear without true descenders. Normally there is room for a descender to drop three dots below the notational line but some printer manufacturer's only use two and reserve the bottom line for underlining. This should be avoided because with only two dots you sacrifice the loop on 'y', 'g' and 'j'. It always looks better if you get a printout which only underscores the letters without descenders; a broken line looks better than a confused mess. If you're not sure how the characters are formed ask to look at the manual. Somewhere in the appendices there is usually exploded diagrams off all the letters which the printer can produce.

The true measure of a good NLQ mode is to ask yourself if it looks like a daisywheel or typewriter printout or just a less dotty version of draft mode.

If you anticipate doing hi–res screen dumps, check that the printer has this facility and examine the quality.

The Right Stuff

One way to check how well a printer is made is by it's weight: lightness often means skimped strengthening and the use of plastic where metal would have been better. Watch out for thin plastic protrusions because they will be the first parts to go when you carelessly drop a book or a joystick on the printer.

Check that the print head has a multi–finned, sturdy heatsink attached. The movement of the hammers, their contact with the pins and the pins contact with the ribbon all dissipate energy as heat. If the heatsink is inefficient you may be able to print till the cows come home in January but when summer comes round the printer will probably keep seizing up. You cannot test the heatsink effectively but you *can* examine them carefully.

Another way of assessing the quality of a machine lies in the design of the switches. I dislike those flush switches hidden behind a strip of plastic tape. I much prefer to hear a positive click indicating that the switch has operated.

The overall finish is important, too. By this I mean the quality and permanence of printed labels on the switches, whether the surplus on plastic mouldings has been removed and a general feeling that care has been taken to create a quality product. My own pet hate in this department are firms who'll gladly part you from £300 but are too tight fisted to put a 50 pence mains plug on for you!

How's your MLBF?

MLBF stands for *mean life between failures* or how long, on average, the machine will operate without breaking down. If this value is expressed at all it's difficult to judge its significance

because there are two methods of assessing MLFB: the number of hours printing, and the number of lines printed.

As a rough guide I would calculate that since most printers operate at around 60 characters per second which equates to 45 lines per minute or 2,700 lines per hour. So multiplying an hourly MLFB by 2,700 will be a rough guide but not really a satisfactory guide.

Just to add to the confusion, some manufacturers specify the life of the print head as millions of characters. Frankly, I'd be surprised if the Oki Microline, which quotes two hundred million characters, is nine times better than the German made Mannesmann Tally MT–80 which only claims 30 million.

One thing about MLFB, however it is measured, is that you can use claimed MLFB if your printer fails after six months and you have to resort to the small claims court under the Trade Descriptions Act!

Decibel Level

This is important if you end up doing the books late one night and the kids are asleep next door, or if your trying to listen to someone on a long distance call with the printer rattling away on the next desk.

It's extremely rare to find any kind of acoustic padding inside a printer. Surprising really when you consider that my way of estimating the noise of a machine is by counting how many closed doors have to be in the way before I can't hear it! Try something like this, for example, can you hear it from outside the shop?

Ease of Use

Most of the time a printer, with fanfold paper looped through, will just sit on the table and it will perform faultlessly. There will come a time when you run out of paper and have to lace up a new batch. Logic states that a good printer is one that doesn't call upon the skills of a watchmaker or the agility of a conjourer to achieve the Utopian state of lace–up.

Printers such as the Star NL–10 and Panasonic KX–P1081 have a nice feature whereby the printer will help the process of inserting the lead sheet with a brief autofeed of a few lines.

One day some wretched little piece of paper is going to get lodged inside the printer. If this is going to involve resorting to a screwdriver and pliers or a crowbar it's not going to do you or your printer much good. Always find out how easily the covers can be removed so that the paper path can be laid bare.

Buying a Daisywheel

These printers work by spinning the daisywheel so that the'petal' with the relevant character is rotated into position. A small hammer then presses the petal onto the ribbon and the character is thereby printed onto the paper. The range of characters and the style of the font and quality of print is therefore determined by the size and type of daisywheel employed. Some wheels have more petals than others but, before making your purchase of a machine with a comprehensive wheel, check on the availability and range of extra wheels; a daisywheel is plastic and easily broken.

Most modern daisywheels are *Qume* or *Diablo* compatible which means that they adopt the same codes as one of these to achieve special effects. Most will print *bold* by double striking or *shadow* by offset double striking.

A good manual should be A5 in size, spirally bound to lie open on the desk and should have stiff covers.
The contents page should have long and detailed descriptions of the chapter contents and each subheading should have a page reference.
There should be a substantial index at the back referencing all controls and their codes and indicating where the DIP switch definitions can be found.
Before leaping in at the deep end, the principles of sending escape codes should be explained clearly.
There should be a summary appendix giving all the generic escape code syntax.
A list of all optional extras should be given, including alternative or recommended interfaces.(TX
A full specification of the machine detailing ***all* of the features.**
An explanation of ASCII codes, decimal and hexadecimal numbers should be supplied.
A separate or tearout quick reference card should be supplied.

Fig 1: Optional print styles on the Star printer
Fig 2: The Good Manual Guide

Daisy Strain

Unlike dot matrix printers, the quality of a daisywheel printer is always excellent and this is why the slow acting but relatively cheap daisywheel printer has resisted the advances in NLQ dot matrix, laser, ink jet and other printing methods.

Manual Labours

The quality of the handbook is every bit as important as the quality of the machine. What's the good of owning a Rolls Royce if you can't get it out of the garage?

Figure 3 lays out some rules for buyers; and for the handbook writers! I particularly recommend that you check whether explanations are lucid without being patronising. I also suggest that you make sure that all the printers numerous control codes are detailed and, preferably, summarised.

Forty pages of explanation are totally useless if the writer has forgotten to explain that sending a control code does not mean pressing the CTRL key! Diagrams, example printouts and programs are all an indication of quality and clarity. You'll be lucky if you find an index in any printer manual but if you do it's probably a cut above other manuals.

A tear out sheet which can be kept under the printer is useful for a quick refresher course on little–used codes. Otherwise you could be left thumbing through an un–indexed book for hours on end.

A Change of Face

If MPS803 printouts are not the prettiest sight you've seen, Printkit IV could be the cosmetic surgery you've been looking for.

by Gordon Hamlett

Your MPS803 printer may be fine for dumping off listings and the like but it's not going to impress your bank manager too much when you use it to write that grovelling letter to him. To be perfectly blunt, the typeface looks awful. The lack of true descenders renders the print difficult to read; you keep wondering why a number '9' seems to be printed every time there ought to be a letter 'g'.

Enter Printkit IV from Avon Printer Technology. Not only does it give you proper descenders, but also other features such as italic and bold typefaces and underlining.

The package contains two integrated circuits and two sockets, a resistor, a switch and some solder mop. As the name suggests, it comes in kit form and you must fit it for yourself. To do this you'll need to strip the printer down, remove the printed circuit board, fit the components and then reassemble everything. Tools required include a small soldering iron, wire cutters and a couple of screwdrivers. The whole job could take you a couple of hours.

The instructions included are clear and fully explanatory. Your attention is drawn to the tricky parts and hints and tips are given to help you. The accompanying diagrams are similarly clear and large.

If you don't feel happy about approaching this job yourself, then you can send your printer to APT who will do the conversion for you for a fee of £15.

Once the kit is fitted, you are ready to try out the new facilities available to you. Naturally, the descenders are always there and need no special commands but underlining, italics and boldface are switched on and off via special control codes. When using word processors, you'll find that most of them will allow you to use these commands in your text. Included amongst these are the three most popular word processors for the C64, Superscript, Easyscript and Tasword 64.

Bold is effected by a double strike which does not slow the printer down in any way. The descenders make the most obvious difference to your text and, if you intend to send out a lot of letters, the package is worth having for this alone.

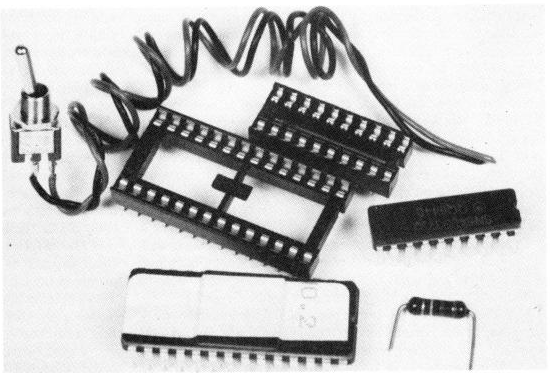
The italic script looks a bit disjointed, as if someone has just taken the ordinary text and stretched it across. Because of this, it is probably best only to print the odd word in italics for emphasis rather than italicising whole chunks of text at a time. It does give you five new characters though: left and right curly brackets, a divide sign, a copyright symbol and a right pointing arrow.

Bold can also be used for word emphasis but would be especially useful for those extra special letters to your bank manager though the extra wear put on your printer ribbon by using this mode should be borne in mind.

Underlining is best used in conjunction with capital letters. Otherwise, it tends to run into the descenders that have been so lovingly created. Spaces can be underlined, or not, depending on the effect you wish to create.

The switch allows the original printer mode to be restored at any time, although the manufacturers are convinced that you will not want to do this very often except as a reminder of the bad old days!

These four additional features will certainly give your MPS803 a new lease of life, and at £30, has got to be a lot cheaper than buying a new printer!



Printkit IV in all its glory.

Facing Up To Printers

Interface–phobia is a state of mind which affects many Commodore users. Broaden your horizons with our simple guide.

by Norman Doyle

Leaving the cosy world of Commodore printers for the tough world of alternative hardware can be a traumatic prospect. Just buying a printer is not enough because the Commodore machines work through the serial port and most commercial printers have parallel Centronics or RS232C inputs. Many people forget to budget for an interface but without it control is not possible.

The mere mention of parameter setting is enough to cause panic to set in but interfaces are probably the least complex peripheral which you could own. A do it yourself interface is one option and not too difficult to implement if you understand machine code but the mere fact that you have to load in software each time makes this awkward to use. The program uses up memory space and can prove impossible to implement if commercial software is being employed.

Centronics links are much more common than RS232C types and, despite the range of models, they all offer very much the same kind of functions. The current trend is towards integral interfaces supplied when the printer is purchased but many, particularly in the cheaper and older ranges need an extra unit.

Most Centronics interfaces are actually serial converters housed in a box with typical measurements of around 150mm by 90mm. The best units not only have a ribbon cable and a serial DIN lead but also have a single connector for the cassette port. This is a power tap to supply the PCB in the interface with the correct voltage. Some interfaces tap their power from the printer's 5V line on pin 18 of its socket but, because this is not standard, you must check that your printer is of this type before buying such an interface.

At its simplest, a connection interface simply collects each bit emanating from the serial port, assembles them back into a binary byte and sends this reconstituted information down a ribbon cable and into the printer as a parallel signal.

Although this is the prime purpose for the interface, there are always other benefits incorporated in each unit. As a typical example I've chosen **Precision *Super–G*** interface.

Most interfaces, including Super–G, are supplied with integral DIN and ribbon cables which allow plenty of distance between the printer and the computer. The power supply lead should terminate in a through connector which still allows the cassette deck to be connected at the same time as the interface.

The Outside...

The body of the unit sports a row of miniature switches which are always freely accessible and much easier to operate than the DIP switches used inside printers. These set the basic mode of the interface's interaction with the printer and these duplicate the function of several of the normally inaccessible switches inside the printer.

The Super–G has a row of eight switches which are of a type which I've not seen before. Gone are the days of DIPs which can only be moved by the use of a strong ballpoint pen and a magnifying glass and these new switches can almost be flicked with a finger nail. It's only the close banking of the switches which prevents this halcyon dream from becoming a reality. The positioning of the switches could be further improved by attaching them to the topside of the PCB and cutting an access hole through the top of the unit. Instead, the Super–G has a superb table of suggested switch settings for a wide range of machines but the unit has to be turned over to facilitate the setting of the desired arrangement.

The top panel could also be further improved by listing the functions of each switch. As an apparent afterthought the manufacturer's, the Supra Corporation, have included a summary sheet inside the manual but a loose sheet can easily be lost.

The switches on the Super–G are fairly typical and control functions such as the supply of automatic linefeeds, setting the printer as device four or five, and the selection of Commodore 1525 printer emulation or transparent modes. The other switches organise the interface output mode to suit the printer to which it is connected.

It's the final category which is probably the most important of the switches. Commodore has its own form of character coding based on the ASCII standard. This has come to be known as

PETSCII and causes problems where graphics characters are concerned. In addition, some of the standard printer commands for the Commodore system vary from the equivalent controls set in other printers. Using the emulate/transparent switch allows you to use commercial software engineered for Commodore printers with any printer which is compatible with the interface.

A secondary benefit of the Commodore emulation is that most interfaces have a special 'quote' mode which substitute the reverse field, graphic control symbols in a PRINT statement into easily readable mnemonics or CHR codes. For the Super−G this means that a reversed heart symbol indicating a'clear screen' command will appear as <CLR>. Each interface has its own system of mnemonics so it would be fruitless to delve further into the Super−G than this.

Although it may seem strange, there is also a facility to printout the raw hex codes which the printer is receiving instead of the actual characters. This is a function which is only appreciated on the rare occasions when it is used to debug an output routine which doesn't behave as expected or when a piece of commercial software produces strange results. With the flick of a switch you get a clear sequential printout of the raw code which may not solve your problem but does clarify the situation.

Daisywheel printers are catered for by a special switch configuration which sends a text only output.

...Inside

All of the switchable features should be duplicated inside the interface operating system especially if, like Super−G, the interface does not possess a reset button. This means that you don't have to fiddle about with switches if a special situation occurs where you wish to vary printer operations from the normal set−up.

These codes usually take the form of a secondary address in the open command, such as OPEN4,4,*25*. The problem with this system occurs when commercial wordprocessors are used. The programs always open their own printer channels and the addition of a special secondary command is rarely catered for.

A desirable feature of the Super−G is the ability to lock the interface so that it ignores any other secondary commands. Simply by opening a channel using one of the special secondary commands alters the interface irreversibly unless the power is switched off. The wordprocessor can then be loaded without worrying about the interface's state being changed.

Why Worry?

Despite waxing lyrical about the flexibility of interfaces I have to confess that my own interface was set on the day that I bought it, according to the manufacturer's recommended settings, and I haven't touched it since!

I've stressed that there is a wide variety of interfaces and the best way to buy one is through a local stockist who can set everything up for you initially. I've selected a few which I would personally recommend but manufacturers are almost always American and suppliers change so regularly that it's not so easy to keep up to date.

Super−G

This is the most recent interface to come under my scrutiny and I am still very impressed with it. **Precision** are the suppliers and the current cost is £34.95 placing it at the lower end of the price range.

I've already covered most of its facilities but the one criticism I have is that the manual could be better organised. The inclusion of an index or a few appendices tabling the special features would help greatly.

Micrografix MW 350

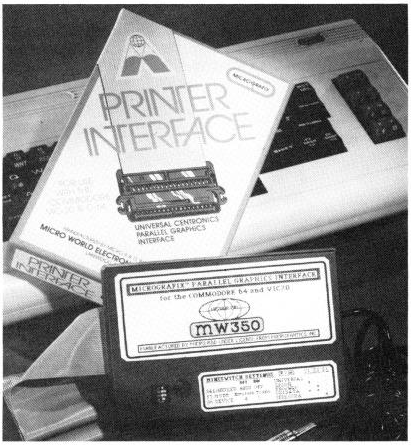
This unit has six DIP switches situated in a recess on its upper surface, next to a reset switch and a panel which gives details of the switches' functions and the correct configurations for the major printer types.

One useful 'extra' is the ability to print out a status report detailing the parameters with which the interface is currently operating. At a glance you can see whether your linefeed is being generated by the interface and even which printer's configuration your currently set to. More of a luxury than a facility, this could be useful with some non−standard software.

The interface is also suitable for daisywheel printers and has emulate 1525 and graphic mnemonics modes as well as transparent.

Two additional features make this an intelligent interface which makes the whole process of printing easier. Firstly, control codes can be sent to the printer even in emulation mode by preceding the command with an extra CHR$(27) control character. Secondly, and more importantly, there are a series of extra commands for setting page width, length, perforation skip and one to make the printer pause at the end of each page for single sheet feed. With an interface like this who needs a sophisticated printer?

Just before you start wondering why I mention any other interfaces when this one appears to sing, dance and make tea at the same time, we come to the cost! The cheapest price I've seen is £60 in a sale. Versatility at a price.



Device One

The Device One interface is another one at the top end of the price range but it's the extra facilities which make it really excellent value for money.

Device One is no dumb add–on, it has 16K of ROM and 16K of RAM! This enables extra facilities such as four internal character fonts, font customising, plus the ability to print pictures, calendars and banners.

To accomodate access to these extra abilities there is a set of 32 commands, giving the printer another operation mode apart from emulate and transparent. Semi–transparent mode allows the interface commands to be executed even though the printer thinks it is operating in transparent mode.

Pictures can be sent down to the printer and printed out in half or full–tone. You could combine this with calendars printed out by the interface or even as part of a banner. Banners are created by causing the printer to print lengthways down the paper instead of across the width in larger than normal lettering.

With 16K of RAM available you also have an extensive printer buffer.

Software is provided with the interface which allows you to access the interface's facilities more easily and two font editing programs. One of the font editors even allows you to hunt through the computer's memory for a character set which may have been used in a game.

The Connection

The Connection is a lot simpler to use than most interfaces because it is printer specific and has its own command set for controlling printout formats. There are only two DIP switches to worry about and even these are hidden underneath the label as though they weren't really necessary. If you just want to use your printer as a 1525 then they *aren't* necessary for most applications.

One switch determines whether the interface is in transparent or emulation mode and this determines the function of the second switch. This switch determines whether a linefeed is sent or not in transparent mode. In emulation mode it selects a secondary mode which is either 'extended' or 'limited'. Extended mode enables the interface to respond to secondary addresses and to use its own special commands. Limited mode disables the response so that software compatibility can be maintained.

The commands cover all the printout dimensions, allows hex dumping, and another which breaks up program listing lines at suitable points to improve readability.

A special command, the macro, is quite useful for it allows characters to be reassigned. For example, if you want to print <CLR> in place of CHR$(147), you can do it through the macro command. This means that specially formatted listings can be made using mnemonics of your own choice.

BI Interface

I include this interface because its one that keeps turning up in various guises. Batteries Included are one of the foremost

Canadian hardware and software producers and this interface of theirs is reasonably priced around £30.

Last I heard, Ariolasoft were marketing this one but, by now, it may be in someone else's hands. Whatever the case I have no doubt that on a dusty shelf or up and down the country there's a BI Interface or two.

The functions offered are fairly basic and no special functions are included but the interface is a reliable link for your printer and ideal for those who prefer the utilitarian to the exotic.

Centronics Unseen

There are several interfaces I've yet to see but it's only fair to give them a mention.

Evesham Micros have the ***Xetec Supergraphix*** interface for £69.95. This sounds a little like Device 1 because it has downloadable fonts and a large buffer.

Stack Computer Products' interface is compatible with the full range of Commodore computers and costs £59.95. If you also want 8K of buffer space the price is £80.00 but a Centronics cable which links the user port to the printer will only cost £18.00

An alternative approach to interfacing is provided by **Microsnips** with their Centronics lead and driver software for £19.95.

Delta Pi Software have two interfaces, a basic one at a very low price of £29.95 and the Super−G at £34.95.

A very neat interface is available from **FCC Systems**. The electronics are contained in a small cartridge on the rear of the Centronics connector. This looks neat but could cause problems with some printers by fouling the paper feed. The FCC interface is priced at £59.99.

In addition to their £15.00 Centronics printer cable, **H&P Computers** also has extension cables which can further increase the distance between your computer and printer. A one metre cable costs £5.00 and a two metre cable is priced at £7.00.

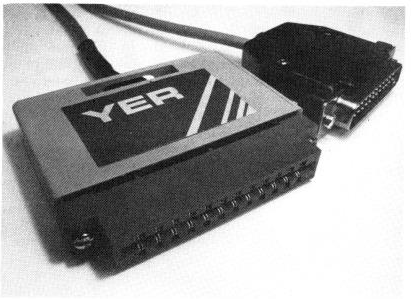
The RS232C Alternative

Although Centronics links are the most common printer connection, there are several models which favour RS232C links. The advantage of an RS232C printer is that the interface can also be used for linking in a modem. The disadvantage is that the connection protocols are more complex than Centronics connections.

If you're a novice, you're strongly recommended to obtain a software disk that will help you to set up the parameters. In most cases a suitable program is supplied with the interface but always check before buying.

A specific disadvantage with RS232C connection on the C64 is that opening a channel automatically sets up a buffer at the top end of Basic memory. Starting at around 9DFF, the position of the buffer can overwrite any variables that the rest of your program may be using. This is further affected when the channel is closed and the top of memory restored to its normal $9FFF position. Now any variables that were set up during the RS232C communication phase will be wiped out. Its rather like executing a CLR statement at the start and finish of RS232C interchange.

RS232C interfaces are not as rare as you might at first think. Most companies who sell Centronics interfaces also stock RS232C connections.



Brain Boxes and **York Electronic Research** both produce respectable RS232C packages but the Brain Boxes' connector has switches on it to help permanently set up your interface. The YER unit lacks any switches but has an excellent piece of comms software along with a port initialisation program and a transparent printer driver.

The Brain Boxes package costs £49.95 + VAT and the YER system will set you back by only £29.99.

Other companies producing interfaces are:

Delta Pi Software whose interface and software retails at £57.44. **Stack Computer Products** RS232C connector costs £33.00

An intelligent RS232C interface is manufactured by **FCC Systems**. With its own processor and a massive 64K buffer high data transfer rates can be achieved and the computer is tied up for as little time as possible. The snag is that the system cost £115.00 but, for those who want a cheaper interface, FCC also have a low cost interface for £35.00.

The lowest cost interface is that produced by **H&P Computers**. With an Xmodem comms program the whole package costs only £25.00.

Keep Up To Date

The printer interface scene is changing and evolving all the time with more and more printers including machine matched, Centronics interfaces. There is often still a chance that an external control system will enhance a printer's specifications in the way that Device 1 operates. As RAM chips continue to fall in price there may come a day when interface buffers will free computers as soon as a high speed download has been completed. The result for the user will be freedom from the time delays involved while waiting for the printer to do its stuff giving hours of uninterrupted word processing and programming.

Precision Printing

Are four heads better than one? Precision Software's Peripheral Printer sticks its neck out.

by Norman Doyle

The first thing that struck me about the Peripheral Printer was its beautiful streamlined appearance but when I looked inside I thought I was seeing things. Four print heads? Surely this is some kind of joke? After about ten minutes of using it I was thinking how come nobody had thought of this before?

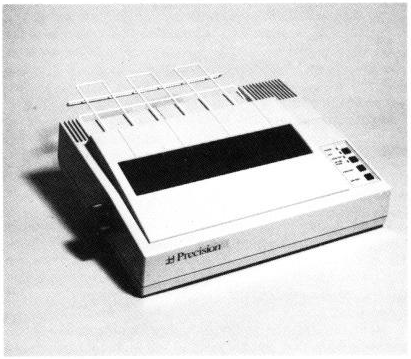
This is the most innovative and exciting peripheral that I've seen for a very long time. The technology of dot matrix printers has reached the maximum speed which a single head could produce but this machine increases that potential fourfold. To say that I'm amazed would be an understatement!

By nature I'm a cynic and even when faced with a printer such as this I am not the type of reviewer who will gasp at high printout rates. My second reaction to the machine was to say that four heads mean four times the noise. I was wrong. Alright, so it is a little noisier than many of its single-headed brethren but the benefits far outweigh this drawback.

Logically, this machine offers over four times the speed but also offers four times less wear on the heads per document. Added to which there are a few more innovative features which makes this my peripheral of the decade!

In our article on printers we have laid in heavily on the deficiencies of the switch systems employed on printers, especially the widespread use of DIPs. Hold this printer up for scrutiny and there's not a DIP switch in sight. Instead a small cover to the right of the printer hood is removed to reveal twelve, well-spaced slider switches which even the clumsiest of fingers could operate with ease.

This bank provides all the usual functions that DIPs usually offer; Epson/IBM mode selection, linefeed, paper end detection, character set selection, fixed form length and line spacing plus zero slashed/unslashed mode. Curiously the twelfth switch serves no purpose.



In front of this switch well are four switches and four LEDs. Apart from the usual online, form feed and linefeed buttons, there is an NLQ button which overcomes the problem of selecting this mode through software control codes. The switches are rugged, positive controls and the LEDs leave you in no doubt about the operating mode. Power, paper out and online are all indicated by their respective LEDs and the NLQ light comes on when that mode is in operation.

Fast But Firm

The use of four heads means that the general construction of the printer is extra rugged to counteract the mechanical shock of four sets of matrices hammering against the platten at the same time. This solidity may have resulted in a hard looking exterior but the sleek lines of this machine belie this possibility.

Enough of this eulogising, let's take a look at the

The quadruple heads give this printer a print speed of a staggering 480 characters per second in draft mode and enables NLQ printing at a rate which beats some printers in draft mode! 80 cps in NLQ is not to be sniffed at.

In bit image graphic mode for hi-res screen dumping, the printer performs in unidirectional mode which slows it down a little. Even at that it still beats every printer I've seen because having four heads ranged across the paper's width means that the carriage does not move the heads more than about two inches.

Apart from NLQ and draft modes the printer also offers condensed and enlarged modes, Elite in normal and enlarged, italic, super-and sub-script, double strike, emphasised plus underline. In NLQ mode the Elite, emphasised, double strike and super/subscript modes cannot be used.

My only real complaint about this machine is the manual which is presented as a paperback (perfect bound) and liable to split or shed pages as it gets used. The contents page is limited to general headings and the information is so compacted that it's difficult to find the information that you need quickly. A full index in the back of the book would have helped enormously.

Interface Inclusion

As standard, the Peripheral Printer has a Centronics interface fitted but this can be replaced with an RS232 module. For Commodore owners the Centronics interface is recommended because **Precision** are offering as special price on the Super–G interface module bundled with the printer.

In the article on interfaces I have already praised the Super–G for its ease of use and facilities so, apart from commending Precision's offer, I will say no more here.

Conclusion

You may have guessed that I'm bowled over by this product. It produces smart looking NLQ documents but it's a pity that some of the draft features are inaccessible. As far as speed is concerned this is heads and shoulders above the rest. If speed is a prime concern then this is the *only printer for you.*

brain boxes

commodore 128

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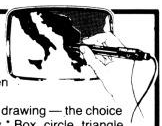

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Printer Printout

Printers come in all shapes, sizes and decibel levels. We put sixteen different machines under the microscope.

Jon Vogler

Placing the written word onto printer paper may seem like a fairly mundane task but there are more makes of printer than there are types of computer. In fact, there are so many different printers available for your Commodore that it would take too many pages to describe them all.

I've limited my comments to some of the more popular machines that I've met: twelve dot matrix, three daisy wheel and one thermal printer.

BROTHER M-1509

This printer is a beauty: a low, stylish, 132 column machine with many desirable features. Unlike many printers the mains cable and data cable enter at the side avoiding the danger of fouling fanfold paper trains.

With a similar thought for accessibility, the power switch is situated on top of the printer and an array of membrane switches permit typewriter standard NLQ near-letter quality selection and paper feed type: continuous fan-fold paper, single sheet feeding or automatic sheet feeding using an optional cut-sheet feeder.

Ribbon changing can be a very messy process but the Brother cartridges include a little, plastic running guide attached to the ribbon which is easily clipped into position on the print head, leaving hands and fingers immaculately clean. Beneath this ribbon compartment are found the control dip switches. The switches have a plastic cover to protect them which also bears upon it a description of each swutch's function; a very useful feature.

All panels are removable so that the printer may be cleaned but some of them proved could only be freed with difficulty. The unusual tractor-drive attachment for fanfold paper clips onto the back of the printer. This ensures easy loading of fanfold and cut-sheet paper as well as allowing easy removal of paper jams.

The printout quality is excellent: a sharp, NLQ typeface with curvaceous descenders in either roman (the standard style), italic, bold or boldface italic. My only criticism is a personal dislike of the slight discontinuity on the knee of the lower case 's'.

The manual is neatly laid out and has excellent diagrams, but the contents list is brief and only occupies a single page with no index to support it. Despite this unfriendly referencing system, all the

This is the STAR NL-10
This is NLQ mode
This is italics
This is bold faced type
This is bold-faced italics
This is underline and
here are some descenders
yyyyy ppppp ggggg jjjjj

This is the CITIZEN 120D
This is NLQ mode
This is italics
This is bold faced type
This is bold-faced italics
This is underline and
here are some descenders
yyyyy ppppp ggggg jjjjj

necessary information seems to be contained alongside a business-like summary of all of the escape code commands. One slight blemish is the omission of a brief description of what each escape code achieves.

If desk space and bank account will allow for a wide platten machine, this is a highly recommended and excellent printer.

CITIZEN 120-D

Unfortunately, the Citizen is not so highly recommendable. I was not impressed with this machine's noisy performance and the sub-standard appearance of the NLQ mode printout.

The compact, simple design of the machine is not helped by the ugly, tractor-drive attachment. When the covers of the drive sprockets are open they also obstruct the opening of the top cover.

Sheet feeding proved hazardous too. Sheet or tractor feed can be lever-selected but the friction feed failed to grip standard weight paper securely enough when I tested this facility.

The overall finish is skimpy, extremely thin metalwork and barely adequate plastic. The print head looks particularly flimsy and delicate and in my tests only achieved a speed of 67 characters per second instead of the specified 120cps.

The untidy control panel sports just three switches and three indicator lamps. The letter quality and auto sheet feed functions on the panel seem to be afterthoughts hurriedly added to an existing panel.

The printer does have some good points including the simple selection of print face via the control panel: correspondence draft quality, italic, emphasised and reduced. There is also a replaceable interface cartridge to match the printer to the computer.

Most printers require an additional interface to match the Centronics or RS232 sockets to the Commodore output ports, so allow for this when comparing the price of the Citizen against other makes.

Finally, the handbook has a convenient tear-out card showing all the necessary codes. My pet hate with this, and other, manuals is the lack of an index but otherwise it is nicely produced.

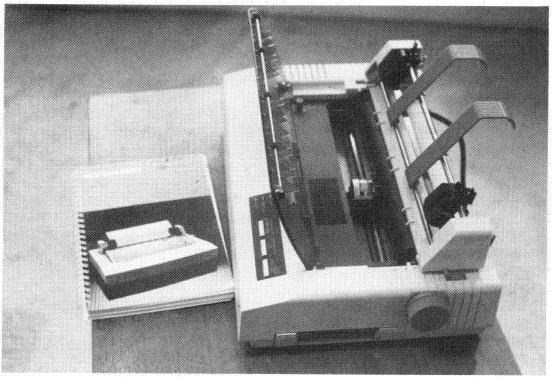
EPSON LX-86

This has recently been replaced by the superior LX-800 which offers a sans serif typeface in NLQ, a 3K internal buffer and six user-defined symbols which could even be used for personal logos. The printout speed is slightly higher than the LX-86, as is the price of £275.

In the absence of hands on experience with the LX-800, I can only really consider the very similar LX-86 which should still be around for months to come.

In its day, the LX-86 replaced the LX-80 as Epson's standard workhorse and included many enhancements lacking in its predecessor. The tractor unit became an easily removable device with full width adjustment enabling the printing of address labels and pay-slips.

Unfortunately, the positioning of the tractor feed spoils the streamlining of the printer design and also obstructs the feed selection lever. This means that if fanfold



paper has been loaded and the user then wishes to knock out a quick enevelope, the tractor drive has to be removed to switch to friction feed and then replaced after the envelope has been completed.

The arrangement also has the effect of making the tear–off strip inaccessible with the tractor feed fitted, just when it's needed most! The quality of perforations on fanfold paper is of varying effectiveness and a tear–off strip is often greater and therefore desirable. Although Epson do specify that a tear–off lid is supplied with their roll paper holder. For sheet feeding a separate cut sheet feeder is available as an extra.

Although my printer is only fitted with a standard parallel interface, Epson tell me that a whole series of interfaces are available including one for the Commodore serial port.

The speed claimed for this machine is 120 characters per second but my tests produced a slow and noisy 57cpi. In addition, the NLQ mode does not permit italics and the appearance of the NLQ is not quite up to business correspondence requirements despite the crisp and clear appearance of the well–formed characters.

In standard mode there is a choice of eight different typefaces selectable from software codes or through a somewhat complex system using the control panel. Neither of the printer modes supports proportional spacing.

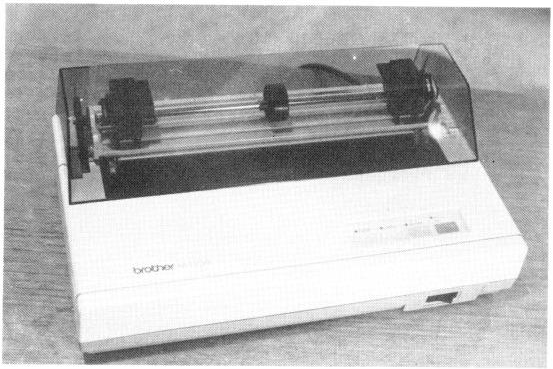
BROTHER M–1109

This is a minute machine measuring only 13x8 inches, making it ideal for those with limited desk space. Although Brownie points are awarded for the inclusion of both serial and parallel interfaces as standard, it immediately loses them again for a miserly control panel.

Although NLQ mode can be selected from one of the two membrane switches on the panel, there is no facility for executing a form feed.

I often suspect that many printers have tractor feeds fitted as a design afterthought and the fitting of this unit causes problems on the M–1109. Most of the problems result from the trade off between compactness and convenience.

The tractor feed not only inhibits the feed control switch but also negates the use of the tear–off strip on the platten cover. Similarly, the knurled wheel, which Brother have used in preference to a paper feed knob, is rendered difficult to use by the tractor feed attachment.



Apart from using the neat plastic cover to cut down the noise, the user can also utilise a special quiet printing mode. This is not easily accessed through commercial products for example, when planning to make half a dozen telephone calls while printing out a trial balance because it can only be controlled by software and few products allow for unique commands such as this.

The printer is extremely slow, clocking in at a tested 43cps against the claimed 100cps but it does have a good typeface.

The printer package is marred by an extremely poor manual containing only the briefest contents list, has no index at all, no handy reference cards and no explanations of control codes. In addition, the diagrams relating to dip switch positions are extremely confusing.

STAR NL–10

I liked this machine immediately. It is extremely well made and robust with many delightful features.

The first main feature is that the tractor feed is built–in so that the machine maintains a clean, low profile and all parts of the paper feed path are accessible in the event of a paper jam. An intriguing automatic loading sequence comes into play if the paper feed control lever is moved back, so loading fanfold or cut sheet paper is extremely easy on this machine.

I also liked the ribbon cartridge which has a removable sub–cassette to keep ribbon costs down, and the generously large knob attached to the platten roller.

Another attractive feature is the interchangeable interface which is fitted with a single screw ensuring that versatility and utility do not result in poor electrical connections.

Compared to many of the other printers on test the lugs and brackets holding covers in place were all short and stout and looked as if they would happily endure hard wear. It would have been better if the cartridge could have been fitted about half an inch nearer the outside edge of the printer, away from the paper track. For most applications this problem can be solved by placing the leftmost sprocket hard over to the extreme left where the printer head will still reach the edge of the paper.

Above all, I liked the generous control panel with no less than seven indicator lights and five switches. From the panel the user can select NLQ, bold,

pica, elite and condensed printfaces. Italics can also be accessed in both bold and NLQ modes.

Another panel feature is micro-feeding: moving the paper a fraction of a linefeed up or down. This is useful for printing complex mathematical and scientific formulae or simply for placing the paper accurately before a print run. There is also the facility to reset the left and right margins: very handy for the occasional non-standard document.

The Star is a big machine measuring 16x13 inches but this space is well used for robustness and convenience. The only real complaint is with the rather cursory indices in the instruction manuals one for the printer and the other for the interface. However, there *is* a gaily coloured prompt card printed on plastic-coated paper but it doesn't include a list of the various control codes.

With the prices now as low as £248, the Star NL-10 gives the best value of any of the machines covered here.

OKI MICROLINE-182

The Microline-182 is business-like in appearance: shallow, flat and square with a tiny, unobtrusive control panel.

The low profile is maintained, even when fanfold paper is being used, by mounting the tractor sprockets on the platten spindle itself. Placed at either end of the spindle it means that the user is not only limited to A4 fanfold, but that the loading of paper is also slightly trickier because the sprocket wheels cannot be adjusted independently. The manual does show an alternative, more conventional tractor feed as an optional extra.

The ribbon cartridge is minute and makes me suspect the veracity of its claimed capacity of three million characters f he Brother cartridge is twice as large and only claims half a million!

The interface socket is badly positioned so that the ribbon cable is guaranteed to interfere with the paper path and the streamlined shape of the printer is spoiled by a paper-tear device which engages awkwardly in slots on top of the machine.

The Microline looks shoddily made with thin, plastic panels and a paper feed selection lever which looks particularly frail. On my sample the colour of the plastic cover didn't quite match that of the plinth, one of the plastic lugs had already broken off, the connector on the back was upside down whether in error or by design I know not and the mains cable has a right angle connector which means the cable leaves the machine in an awkward, sideways fashion. There was also an extremely fragile looking wire clip whose function I could not ascertain and the dip switches could only be reached with the aid of a screwdriver.

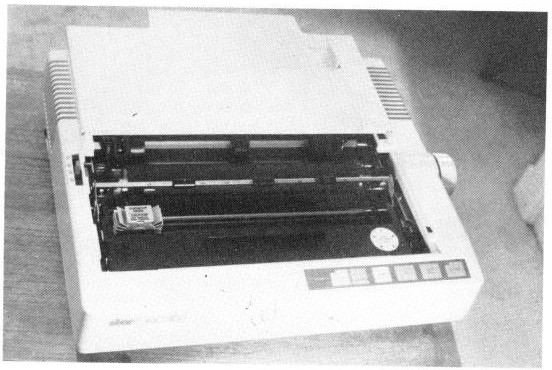
The machine is strictly IBM compatible which means that many printer serial interfaces would not be able to use Commodore printer emulation. Otherwise the facilities are so limited that the IBM codes should not prove too difficult to learn. The only faces are pica and elite in condensed, double width or with underline and without italics. What is classed as an NLQ mode failed to impress with its poorly shaped characters and lack of true descenders on the 'g' and the 'y'.

The manual is very poor with ugly two colour printing and slang Americanisms such as:

LPRINT "Who you gonna call?"

More importantly, the index is inadequate omitting such important headings as NLQ. Dip Switches later found under: Switches, internal circuit board and Boldface found under: Printing, enhanced..emphasised, but with nothing under Enhanced or Emphasised!

All in all I was not impressed with this machine.



KAGA TAXAN KP810

The KP810 looks very similar to the Canon PW1080 but, considering its age, it seems a little overpriced. It runs quietly apart from a clunk at the end of each pass, is easy to load and has full compatibility with Epson codes.

Despite the lack of an indicator mode it is nice to be able to select NLQ from the panel of switches on the front of the printer. NLQ does not support italics or boldface but there is a wide range of print modes and fonts giving variations on the pleasant character set with attractively curved tails on the decenders.

For those willing to trade off speed for quietness, there is a special half speed mode which will please the neighbours during a nocturnal printing session.

The manual has a very detailed contents list, excellent line diagrams and numerous tables detailing the various character sets and their dot patterns.

I didn't like the flush switches on the control panel and found the platten would not pass paper thicker than an original with two carbon copies.

Despite my dealers opinion that this machine is not to be recommended, I'm

afraid I must disagree and say that I was favourably impressed with its overall performance.

SMITH CORONA D200

This model comes from an American company with a fine reputation for typewriters and printers largely produced in Japan. The D200 has been around for some time in this day and age that means more than a year! and they are difficult to find over here but worth hunting out.

At a significantly lower price than similar models, the D200 offers excellent NLQ with boldface and italics. The print quality was very good but some of the lower case letters have flat tops and bottoms.

The printer has proper selection switches on the front panel and the dip switches are easily accessible at the back of the printer without having to unscrew anything. The serial interface is in-built and a mains plug is supplied already fitted.

My only anxiety about this machine is the noise it makes: the linefeed is particularly clattery and though this could indicate inadequate engineering I couldn't actually see anything wrong.

In most models the tractor sprockets are "pushers" but the Smith Corona tractors actually pull. With this system, manually feeding paper backwards for re-alignment tends to result in a paper jam. I found that this could be overcome by switching over to friction feed when feeding the paper back, then back to tractor feed for printing.

The overall finish of the printer is slightly marred by having a piece of acoustic padding crudely stuck onto its base; necessary no doubt, but not very neat.

I am particularly irritated by the handbook which, though apparently comprehensive by its thickness, actually contains a mere 35 pages of English text with the rest being foreign language regurgitations of the same indigestible material. The contents list is totally inadequate and descriptions are skimpy and most unhelpful.

The outcome is a printer whose good value-for-money rating is marred by a very poor manual.

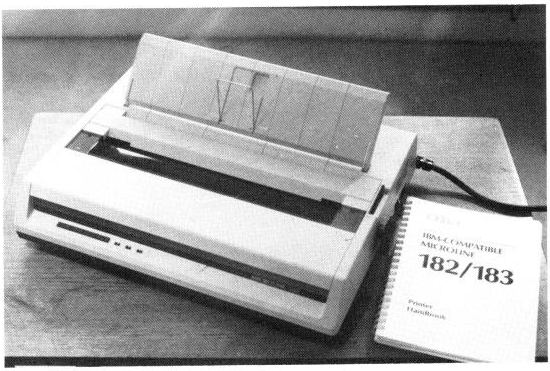
Micro-Peripherals MP165

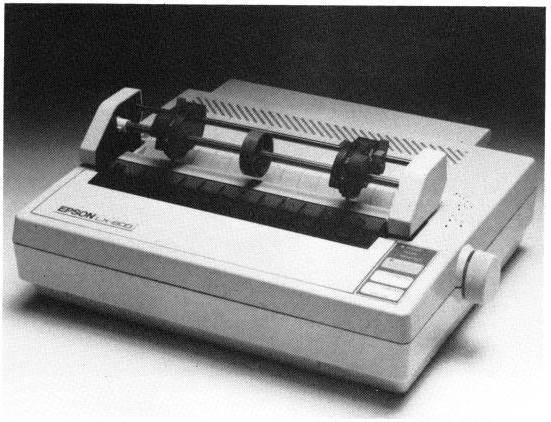
This machine is extremely small and compact but behaves in a very pleasant manner.

Although I was pleased to note a switch and accompanying lamp for NLQ mode it seems a little ostentatious to include lamps for both *Ready* and *On-Line*.

One of the dip switch banks is located in a little cave at the back of the machine where it is easily accessible to a pencil but you need a good light or a pitman's helmet to read what purpose each switch serves. Access to the other bank of switches can only be achieved by unscrewing the cover.

The machine was fairly quiet; in particular the linefeed made virtually no noise at all. Even the paper out signal plays a pleasant little tune rather than the





vulgar squeals emitted by most of the other printers.

The various hinged top covers are rather inconvenient and look a little fragile, however, they have the benefit of being totally removable in the event of a paper jam.

The paper tearing edge is attached to the bail arm (the slim arm which swings in to holds the paper lightly against the platten just above the print head). The tractors do not have locking devices to hold them in place but rely on friction instead. Despite my apprehension about this system, it seemed to work very well.

The printout quality was only fair, having no loops on the descenders, a box-like "c" and the bar on the capital "Q" barely escapes from the circle. Though the NLQ mode supported italics, it did not support boldface.

The manual is very good, if only it had an index at the back then it would be excellent. In particular it emphasises the wide range of character widths and types that can be obtained.

The printer came less well packed than any of the other samples so watch out for damage when you first receive it. The manual feed knob was also a bit stiff with a non-reversible feed. In fact any attempt to reverse feed paper will invalidate the warranty, according to the manufacturers.

The MPI65 is a good printer at a competitive price.

Canon PW1080A

This is a souped up version of the Kagan Taxan KP810. It purports to print at 160cps rather than the KP's 140cps and to perform twelve carriage returns per second, three more than the Kaga Taxan. NLQ can be selected by a front panel switch but in every other respect the two printers perform identically.

The model I tested suffered from the same defects as the KP810: a disturbing clunk at the end of each print line, lack of italics or boldface in NLQ mode (though you can buy a ROM which gives NLQ italics), absence of an NLQ indicator, and an inability to take more than two carbons.

Under test it also suffered several paper jams but I'm prepared to believe that these were my fault rather than the printer.

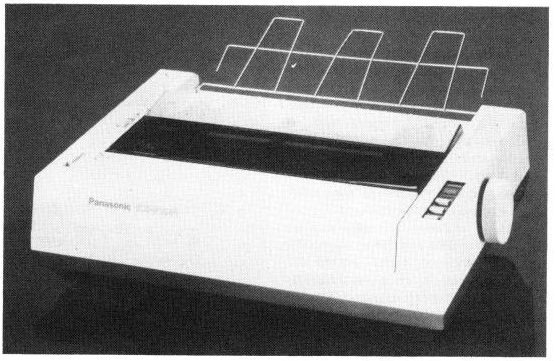
Printing quality was fair; in pica type the "g" has a flattened loop on its descender whereas the "j" curves gracefully.

Mannesmann Tally 85

Testing this machine after all the Japanese printers was rather like driving a Volkswagen after a series of Datsuns: it felt solid and reliable.

The speed is accentuated by a large, selectable buffer. In my test on a 5000 character text in NLQ mode, the computer was free for use in 98 seconds but the printer chuntered on for a further 105 seconds.

The printer head is very quiet especially in NLQ mode and the control



panel with its four switches and associated indicator lamps is far more attractive than those on any of the other printers.

The top cover removes completely to give open access for freeing paper jams or for general maintenance but a hinge would solve the problem of where to leave it while work is in progress. The smoked–finish window makes it difficult to see what the printer is doing and I feel that the temptation would be to leave the cover off all the time.

The tractor feed pulls the paper through the printer. This can be irritating when you have to lose a sheet of paper each time you feed fanfold paper through. It's advisable to back feed with friction feed set on the uncomfortably stumpy tractor/friction lever selector.

Two excellent features are the slot for exchangeable font cartridges, cunningly hidden behind a hinged door on the front panel, and the software method of overriding the dip switch settings thus avoiding the problem of manipulating inconveniently placed, minute switches.

The dip settings are standard Epson printer options and include Epson/IBM compatibility, line spacing, form length, zero symbol slash suppression, NLQ mode, condensed face, perforation skip, linefeed on carriage return and several international character sets.

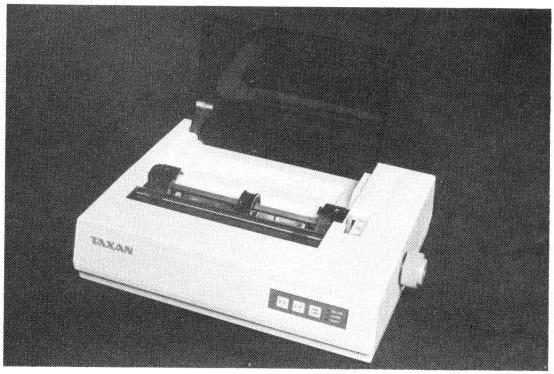
The quality of printing is very high indeed. Boldface and italics are both available in NLQ mode, lower case letters have properly looped descenders and the "c" has curved armed.

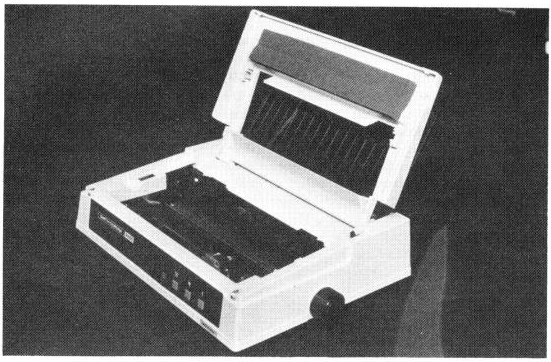
The two–part handbook is extremely good. The Operator's Manual has all the necessary information for using and maintaining the printer while the Applications Manual suggest ways in which your computer and printer can be used together.

Both booklets are well produced, detailed and lucid with a meticulous index and a tear–off prompt card.

It's a fantastic machine. I first reviewed it in 1985 and was so impressed that I bought one. It has served me faultlessly since then and was sold in'as new' condition when I recently upgraded to a laser printer: a tribute to its robustness and reliability.

I may be biased but I unhesitatingly recommend this printer to anyone who can afford its slightly higher price.





Panasonic KX–P1081

This is another superb value printer with which great care has been taken to achieve ease of use. Three different modes of operation can be controlled from the main panel: draft, NLQ, and condensed.

The dip switches are ingeniously located in a cut–out in the base under the print head. Its a pity that the cover is just a cheap piece of cellophane without which the circuitry would get covered in paper dust.

Lacing up paper is usually a hazardous and irritating routine on most printers. Panasonic seem to have avoided this and it's as if an unseen hand grasps the paper as it is fed into the printer and then guides it into position. With a similarly sympathetic attitude towards the trials an tribulations of printer ownership, Panasonic's approach to ribbon changing makes it an easy and relatively clean job to load or remove the cassette.

Unfortunately, I'm not so keen on the

plastic covers, especially the clear plastic one which proved awkward to remove and replace.

The print quality was generally good, especially in NLQ mode, but the lower case'g' lacks a loop. My test rendered a speed of 96cps compared to its stated 120cps and this was achieved reasonably quietly.

Panasonic has produced a detailed handbook with a full index to counteract the modest contents page. Some care has been taken to explain the use of control codes in a detailed and easily understood way.

All these facilities, plus the relatively low price, makes the KX–P1081 one of the best bargains around.

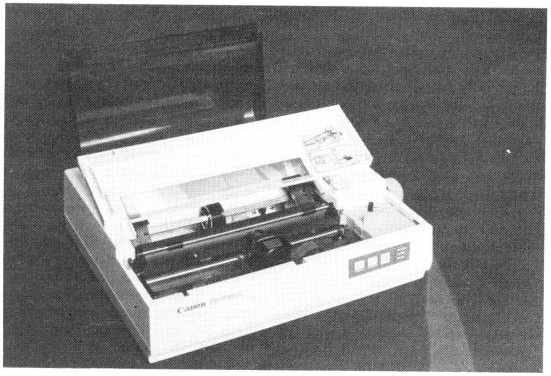
Triumph Adler RD7020

Triumph Adler are part of the Volkswagen group, as you might guess just by looking at the construction of this daisywheel machine: it is well designed and professionally finished, though conservative in appearance and modestly priced.

It is also fairly slow, only registering 19cps on its own self test facility. Often sound and speed have a swings and roundabouts relationship, consequently this is unusually quiet and pleasant sounding for a daisywheel printer.

With many a printer the whole household and some of the neighbours are aware when it's in use but the RD7020 can be rendered noiseless simply by closing the door to the room it is in. Even making a phonecall while it's working in the same room would be possible and yet I still feel that the noise level could be reduced even further with the use of acoustic wadding!

The metal parts are particularly robust and all the electronics are protected within a sturdy, screening, metal box. This robustness appears to apply to all areas of construction: the isolation switch under the main cover has a substantial, bright red striker and another sturdy plastic lever ejects the daisywheel from its spindle.



It was this daisywheel lever that led me into trouble. I accidentally released the daisywheel before attempting a printout and broke it as a result. Daisywheels are not inexpensive items and, though I admit that the fault was my own, I think a little bit of idiot–proofing would not go amiss.

The Triumph Adler daisywheels have a slightly larger diameter than the Qume and Diablo wheels but carry 100 characters six more than either of the others and come in ten international character sets.

The paper handling system is particularly elegant. A single lever operates the automatic feed, neatly moving the bail arm out of the way at the same time, and the tear–off edge seemed to perform better than any I have encountered.

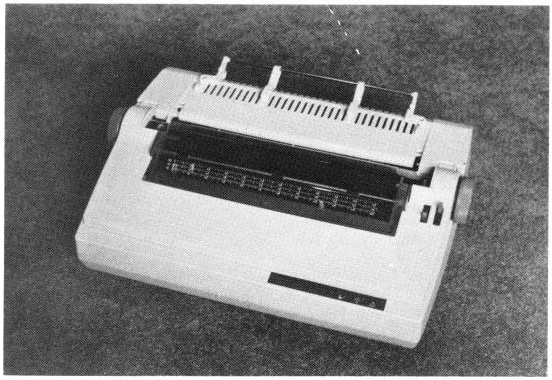
A revolutionary design feature is the way that the data cable enters the printer through a generous slot on the underside. This arrangement obviates the problem of the cable fouling the paper feed.

The front panel switches are properly constructed and there are easy mechanical selector switches for page length, daisywheel type and print pitch.

The RD7020 has a lever which allows the selection of single or multistrike ribbons. As well as a 60,000 character carbon ribbon, the printer supports a 200,000 character multistrike carbon ribbon and a million character fabric ribbon.

Points I didn't like about this machine are the paper advance knob and the ribbon selection lever. The manual paper advance knob is spring–loaded and has to be pulled outwards before it will engage. I found this particularly awkward and it seems to be an unnecessary refinement. On the other hand, the ribbon transport selector is essential but the symbol panel which indicates the mode that has been selected is obscured by the casing housing the electronics.

I only have a draft copy of the manual and there appears to be a reasonable contents list, plenty of explanations of control codes and abbreviations but, inexcusably, no index and no indication of the availability of extra daisywheels.



Qume Letterpro 20P

The thing that impressed me most about this printer was that it was the only one that performed up to its specification when subjected to my speed test.
The Letterpro is constructed to a high standard with a robust, aluminium, diecast lower body and no less than 100 different daisywheels available.

My prejudice against membrane switches was defeated by the type included on the main panel of this machine. They have an extremely positive feel with a neat appearance and the presence of a reverse feed switch was particularly welcome. Not everyone will like the awkward way in which this reverse feed switch works but at least there *is* a reverse drive facility.

When the switch is pressed once it advances the paper by an eighth of a line. To advance by a full line the switch must be pressed eight times. This should not be the case because the paper ought to advance by a line at a time simply by holding the switch down. It does actually do this but, after a short delay to allow for lingering fingers on a short advance, the paper shoots through at a surprising rate. With quick reflexes an operator could learn to anticipate the pause but I feel most people will do what I did by resorting to the manual feed knob.

Letterpro does not take too kindly to carbon copies, with the print intensity switch set at its middle value it could only produce one carbon copy of suitable quality.

Despite this, the paper handling systems are the best features of this machine. The tractor feed and cut–sheet hopper are cleverly designed to be removed and replaced in seconds but it's the paper feed mechanism which really excels.

The tractor feed is truly reversible and holds the paper just as securely on the way in as it does on the way back out again. Freedom from the worries of paper jams which are normally caused by attempting to run the paper back and forth through the printer can open up new, creative possibilities. Text can be printed in several columns to give an appearance similar to these magazine pages by printing the first column, reverse form feeding, printing the next column by TABbing past the first and so on until the page is filled.

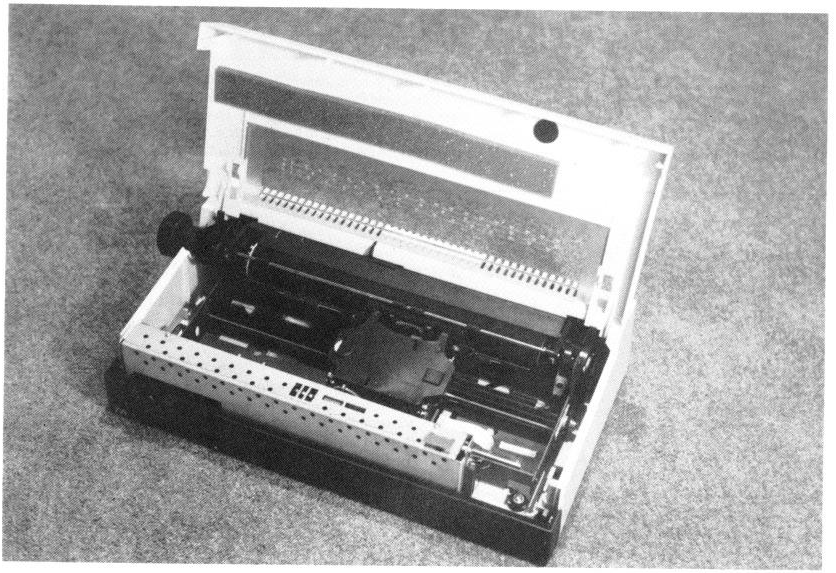
The manual caused me a few problems. It states that the printer is bi–directional but nomatter what I did the head would pass across the paper on a printing pass and perform a carriage return bacl to the left margin. A bi–directional printer craftily prints out the next line as it travels back to the left margin. Speed tests revealed that the printer was close enough to its specification of 20cps for me to assume that it is not a bi–directional machine.

Further investigation revealed that the printer on my table didn't quite match the printer in the manual. These differences were slight such as the ten–gang dip switch was in reality only eight–ganged and the silencer bar mentioned in the manual did not appear on the machine.

The Letterpro printer is extremely well made and this reflects the years of experience which Qume have gained. Perhaps it's also this seniority which accounts for the lack of any truly revolutionary features. Despite this it has to be said that if you want a solidly made, reliable machine with top flight paper handling capabilities, the Letterpro 20P is the obvious choice.

Juki 6200

This whispering giant appealed to me immediately because it was so easy to set up for review and was the quietest of the printers on trial. In tests it performed very close to its claimed specifications, achieving a speed of 27 cpi and comfortably took A3 fanfold paper with an inch or so to spare. Even taking the



large manual feed knob into account, the width of the machine is still only 60cm but the lack of an automatic paper loading system makes lacing up A3 fanfold a tedious task.

The diecast base and all the other metal parts look robust but the plastic used seems rather thin considering the width of the machine. The back of the cover has several thin plastic lugs which I think would break off very early in the printer's life.

The ribbon and Diablo compatible daisywheel are extremely quick and easy to fit and the cables all emerge from the side of the machine, well away from the fanfold paper train.

The manual is informative and surprisingly entertaining. Apart from the detailed instructions and explanations, there's a section on the history of printing and typing. It was in this section that I was amazed to find a small sketch, dated 1890, showing a typist using an electric dictating machine!

The size, silence and simplicity of this machine shows why it has proved so popular in office environments but for home use its price is a disadvantage.

Okimate 20

This is a thermal printer which can take a three colour ribbon for special applications. Although thermal paper is not essential for this printer, it *can* be used for monochrome printouts and could prove to be more economical as we shall see.

Any thermal printer has a print head which contains 24 tiny heating elements that press against the paper or ribbon. If thermal paper is used, the localised heat from each pin discolours the paper but, on normal paper, ribbons work by depositing a small amount of a waxy substance from their surface when touched by a hot pin to form the matrix dot–pattern for each character.

Ribbons can be black but the Okimate allows the use of a tricolour ribbon which gives limited colour printing capabilities. The ribbon cassette looks a little like an audio cassette and the colour ribbon is divided into alternating lengths of red, yellow and blue sections, each group of three being divided by a clear plastic section. Each colour segment is about 25cm long (10 inches) and the printer whizzes the ribbon back and forth at an alarming rate.

This system has three side–effects. Firstly, the printer works very slowly indeed. Secondly, all this ribbon movement increases the likelihood of a ribbon breaking and, finally, the ribbon is consumed at an alarming rate. If a colour ribbon is used in monochrome mode, this will obviously ne used up at three times the rate of a unicolour ribbon. With ribbons costing £6 each the cost factor becomes a serious consideration.

Does it work? Rather surprisingly, it does but paper selection is critical. The feed mechanism doen't handle thicker paper happily and for the sharpest image a thin, high-gloss paper should be used.

The printer can handle expanded, condensed and italic prints as well as underlining, superscripts and subscripts. There is also a NLQ mode as well as the usual draft mode.

The main drawbacks with this machine is the appalling paper feed system, both in design and construction. The very poor instructions in the manual compound these failings and the net result is a frustrating time with the inevitable paper jams. Because the paper has to be so thin it is difficult to load and I've found that thin acetate works best.

The printer could not be seriously considered for frequent use but it does have the potential for providing a lot of fun for those with a passionate desire to experiment with colour printing.

The price of £173 or less frankly reflects the poor quality of construction of this machine.

The Verdict

MACHINE	TYPE	PRICE (£)	COMMENT
Brother M-1109	*MA*	*235*	*No NLQ italics, handbook particularly poor*
Brother M-1509	*MA*	*495*	*Excellent, 132-column printer*
Canon PW1080A	*MA*	*349*	*Noisy linefeed, no NLQ indicator*
Citizen 120D	*MA*	*263*	*Poor NLQ, heavy discounts*
Epson LX-86/800	*MA*	*275*	*No friction feed with tractor drive fitted*
Juki 6200	*DW*	*579*	*A3 feed, quiet, expensive*
Kaga Taxan KP810	*MA*	*349*	*Canon 1080A clone*
Mannesmann Tally MT-85	*MA*	*390*	*Reliability and quality at a price*
Micro-Peripherals MP165	*MA*		*Compact, pleasant, fair quality*
Okimate 20	*TH*	*173*	*High novelty value, can produce overhead projection acetates*
Oki Microline-182	*MA*	*269*	*Business like, IBM standard only, poor manual*
Panasonic KX-P1081	*MA*	*245*	*Good value, easy to use, poor construction*
Qume Letterpro 20P	*DW*	*450*	*Reliable, well made, two way feed*
Smith Corona D200	*MA*	*288*	*Long track record, good value, poor manual*
Star NL-10	*MA*	*248*	*Robust, wide ranging facilities, noisy*
Triumph Adler TRD7020	*DW*	*375*	*A3 feed, robust, good value for money*

Conclusion

*The **Star NL-10** is a superb product at a very reasonable price. It is soundly constructed with an excellent paper feed; the typefaces are wide-ranging and attractive, including both italic and bold typefaces in NLQ; interchangeable cartridge interfaces; versatile front panel controls; and an excellent, though non-indexed, manual. At £248, or less, it offers exceptional value for money.*

*In the daisywheel range, all printers were well constructed but the lower price and wide platten makes the **Triumph Adler RD7020** the front runner.*

Machine Mania

To the layman, the range of Commodore machines in the shops can be confusing. What are they and what can they do?

by Norman Doyle

At the moment Commodore have quite a range of computers available. You can still buy the Plus4 and the C16 at bargain prices, some of the old-style C128s are still around, but by far the greatest numbers are in the C128D, 64C and Amiga models.

Commodore's marketing philosophy for the C16 and Plus4 is not easy to understand. When everyone else was shouting about upward compatibility, Commodore decided to go their own way.

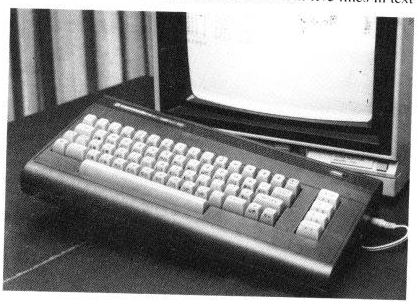
Commodore can't have been too happy with the surge of apathy which greeted their new machines. The main problem was not the quality of the machines, in many ways they are excellent, but that they lacked any compatibility with the highly successful C64. If the Plus4 had been a C64 with advanced Basic and integral firmware business programs, with a cut down C64 presented as the C16, then the addition of the C128 would have given Commodore a range without parallel. In short, I believe that Commodore could have dominated the home market at the expense of Amstrad and Sinclair. Unfortunately, this was not to be.

Despite this apparent error of judgement, the sales of C16s and Plus4s has resulted in the development of quite a healthy user base. This phenomenon is due to heavy discounting and both machines have subsequently enjoyed a relatively long and healthy lifespan.

Commodore 16

Based around the 7501 chip, the C16 has 16K of RAM, though only 12K is available for Basic programming. The memory is expandable to 64K to make it act like a Plus4 without the in-built firmware business programs. Commodore did have plans to produce an expansion RAM pack but it didn't go into production and much praise is due to **Anco** who have been successfully selling their own C16 expansion cartridge.

The screen of the C16 measures 40 columns by 25 rows in text mode, 320x200 pixels in hi-res and 160x200 pixels in multicolour, hi-res mode. Additionally, there are two extra split screen hi-res modes which leaves the bottom five lines in text



mode. All these modes are addressable through the superb, extended Basic commands.

There are no sprites in the computer's graphics armoury which means that games often display attribute problems unless the moving characters are multiples of the basic eight pixel square. If a character doesn't fill the full square, overlap onto the background results in the colour of the moving graphic masking the colour of the background.

Colour capability generally is far superior to the C64. Apart from black, each of the remaining 15 colours can be displayed in one of eight hues, or luminences. This permits the use of subtle shading effects.

The C16 looks very like the C64 or VIC20 until you examine the I/O ports, they all look different from the C64 apart from the video and serial ports. The use of miniature DIN sockets for joystick and cassette linkage has caused problems because of the unavailability of these plugs and the delicate nature of the very thin connection pins.

The cartridge port is also different from that of the C64 but this time there's a very good reason. If anyone was foolhardy enough to try connecting a C64 cartridge to the C16, the result would be an apparent malfunction because of the differing internal memory architecture of the two machines.

By far the greatest strength of the machine lies in its extended Basic Version 3.5. This adds about 50 new keywords to the original Basic which Commodore had clung to since the early PET machines.

Through the new commands, graphics and sound registers can be addressed more easily, the loop structures are more sophisticated and error trapping is at last possible. The built−in machine code monitor is also an asset. Having been plagued by the lack of a C64 internal monitor, this is a feature which elicits my envy.

The C16 has been a much misunderstood machine standing in the shadow of the C64. It is still a bargain today at under £100 but the few software houses who have persevered with C16 conversions are now tiring as more and more of the users become disenchanted with the lack of charisma of the machine.

Plus4

Everything I've said about the C16 is true for the Plus4. In addition to all these virtues, the Plus4 has 64K of RAM fo which a massive 60K is available for Basic programs. Given that the new Basic ROM means more structured and less verbose programs than with previous versions of Basic, the machine becomes awesome in its programming potential.

In appearance, you could be forgiven for not realising the close links with its little sister machine, the two computers bear less resemblance than the C16 does to the C64. Although Commodore intended the Plus4 to ooze businesslike appeal, to my eyes it looks cheap and nasty and belies its real strengths.

An extra port is available on the rear of the machine. This is the standard RS232 type of connector which also appears on the C64. Through this port parallel communications are possible and an adaptor will turn this into a suitable RS−232 link for use with a modem.

The Plus4 got its name because of the four in−built programs contained on special ROMs. These contain a wordprocessor, database, a spreadsheet and a business grahics program.

There are two schools of thought on this subject. If the programs suit your needs, this is the best machine you could ever wish to own. If the programs fail to satisfy you then they may as well not be there.

Another irritating fact is that the Plus4 is generally supplied with a cassette recorder but the application software is geared up solely for disk use! This means that buyers of the Plus4 also have to fork out an extra £200 for a disk drive, or fiddle about with the internal monitor to access tape. I often ask myself why Commodore didn't allow dual operation of tape and disk but always come up with a stupid answer.

The wordprocessor allows a maximum line width of 77 characters. My first reaction was to ridicule the fact that this was decided upon despite most printers (Commodore's included) have 80 characters to a line. However, I then realised that I always set a left and right margin of five characters' width, so 77 characters is, after all, quite reasonable.

Once all the text has been entered for a document, special commands allow lines to be inserted or deleted, the movement of blocks of text around the document, set the page length and the number of lines which will appear on that page, and has a function which enables the user to search for a specified word and change it when necessary.

Other commands allow you to set tabulation points, centre lines of text on the page automatically, right justify a document, and to load, save or even merge another file onto the text in memory.

The database allows each record to contain a maximum of 17 fields (pieces of information) with a maximum of 38 characters per field. The maximum number of individual records in a single database is restricted to 999 but this can be less if all of your fields are used with the maximum number of characters.

Once your database has been set up, there are several commands at your disposal to help you to sift through the information. One of the normal functions of a database is to sort the information into alphabetical or numerical order and this can be done on the Plus4. The main requirement, however, is

the need to be able to extract information. To this end, there are *Search* and *Review* facilities. Review simply flips a number of records sequentially onto the screen, starting from a specified record number. When a desired record is found this function can easily be aborted. Search allows you to find a specified record by allowing you to specify a string of characters, such as a friend's surname, and the computer will pull this from the file and display it onto the screen. The database also allows the user to print out a report file which only itemises selected data from each record.

The spreadsheet is a fixed frame type, having a matrix measuring 17 columns by 50 rows. This gives 850 cells but only a three by twelve block of cells can be viewed at a time. The cells can be assigned complex formulae which automatically calculate its contents according to the contents of other cells specified by the equation.

The graphics program is more an extension of the spreadsheet than a stand alone module. It is very disappointing allowing only bar and point graphs. It would have seemed reasonable to have expected a pie chart with the graphics capabilities of the machine. Commodore's excuse is that it maintains compatibility with all printers but surely those owners of archaic dot matrix or daisywheel printers would soon learn that some of the graphs were unprintable and that owners of good dot matrix machines would have benefitted from extra flexibility. Commodore decided that it was better to penalise all with this bureaucratically democratic facility!

Owners of C64s with disk drives can benefit from buying a Plus4 at today's low prices. For less than the cost of four applications programs they can buy the Plus4 as a dedicated business machine, sharing the C64's drive. For others, it's not such a bargain unless you're willing to cough up for a disk drive and printer. You'd probably be better off with a C128.

Commodore 128

The C128 brought Commodore back onto the right lines for system development. Upward compatibility does not mean that you can't run a toatlly different Basic and change the architecture about to suit the new regime. You simply include the old machine inside the new one, and upgraders will still be able to use their old software until the new programs can be afforded. Throw in CP/M as well and you've got a multi–million seller.

Well it was a nice theory but it faltered because of the reticence of software houses to speculate on the 128 side of the machine in deference to the guaranteed sales of C64 products. If the houses had been willing to invest in the C128 by producing software today to raise profits tomorrow, then the scene could have been all that Commodore had envisaged. The C128 is the best eight–bit that Commodore have produced. It has relatively fast disk access and stacks of memory to play with. The V7.0 Basic is an improvement on version 3.5 and the RGB facilities means the best Commodore picture you've ever seen.

What shattered the software houses' confidence? Commodore should have more readily put their money where their mouth was both for the 128 *and* the CP/M modes. Investing capital to get selected, reputable companies to produce a reasonable software base would have shown their confidence in the machine's success more effectively. A range of adapted and inexpensive CP/M business programs could also have aroused the interest of the small business fraternity giving second wind to the sales drive. Commodore must break their arrogant attitude that all they need do is produce the machine and then the software world will support it. Who wants to buy a machine that has no software; who wants to develop software for a machine with a small user base?

The original C128 did not last for long before the C128D appeared. With 128K of memory to fill, few users have a lifespan that will outreach the time that a cassette machine takes to load a suitably large program! The C128D with its classy separate keyboard and integral disk drive is the machine that should have been launched originally.

Little has been said about the C128D in the computer press and yet it's such a superb machine. Admittedly the 80/40 column split can be a bit of a pain but I've known worse situations.

The keyboard is very professional looking and quite comfortable to use. Hacking in data is facilitated by the numerical keypad and, once you get used to their'new' position, the function keys are easily reached. This layout did initaially cause probablems with games using keyboard overlays but, now that software houses take this into account, life isn't so bad.

The disk drive is a 1571 double–sided drive which means better value for money where disk storage is concerned. Although this pushes bytes around 17 times faster than the old 1541, when your using the machine in C64 mode the brakes are applied and it's back to relying on software turbo systems.

The C128 could have an important role in a business. All of the text in this magazine was processed on one and the editor loves his C128D dearly. The software base is there but you have to look for it, perhaps another price cut would breathe new life into the machine.

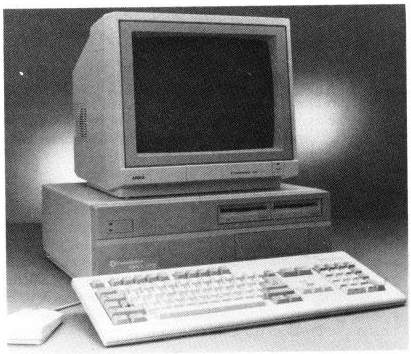
Amiga

The Amiga is Commodore's new flagship. It's not their first foray into the 16–bit market but it's certainly their best. With the A500, A2000 and, while stocks last, the A1000, their is plenty of choice. The A500 at its current price of around £500 has still been criticised as being too expensive compared to the Atari ST but, let's face it, it beats that machine by light years and a higher price didn't stop the BBC Micro from gaining a fair proportion of the eight–bit market with less to commend it.

The features of the Amiga are almost legendary: 512K RAM, the Blitter high speed data transfer chip, 320x256 up to 640x512 pixel resolution, more colours than a hippies wardrobe, built in text–to–speech facilities, a stereo sound chip of awesome capabilities, integral 3.5–inch disk drive...this list could go on forever!

When you consider the A2000, the true power of the machine becomes obvious. With 1Mb RAM standard but expandable internally to 9Mb, multitasking capabilities and the new Bridgeboard system. Although the Bridgeboard appeared to have a few glitches in the original A2000, Commodore now claim to have cured this and I am waiting with baited breath to see if full IBM XT level compatibility is possible. At the Amiga launch cynically seasoned journalists were heard to gasp when the Amiga was shown running Microsoft's MS–DOS graphics program, Deluxe Paint in Amiga mode *and* the Amiga demo programs all at the same time!

Time will tell if the Amiga is a winner, it should be but Commodore have had so many winners in the past that have fallen before the winning post. It all depends on marketing but Commodore seem to be gaining the lead which has always been their rightful place.



Of Mice and Pens

Computer graphics can produce stunning results, but the artist often needs a help in hand.

Norman Doyle

The difference between conventional art and computer graphics is that the maestro and the medium no longer come into contact. Instead a remote control device of some kind must be employed. This can take the form of the keyboard, a joystick, a mouse, lightpen or graphics tablet.

For most people the first graphics tool will be the keyboard or a joystick used in conjunction with one of the many graphics programs which are currently available.

Using the keyboard is probably the hardest way in which to create a picture. The use of cursor keys is simple for straight horizontal or vertical lines but diagonals and arcs are almost impossible to create accurately in freehand mode.

Although most art packages have special facilities for drawing such shapes, there will come a time when the design calls for a spiral or a specific parabola which cannot be created in anything other than freehand mode.

Working Sticks

Even if they own no other peripherals, most computer users have a joystick in their collection and this must singularly be the most common tool used in graphics.

The selection of a joystick is one of personal choice. I am currently using a ***Quickshot Turbo*** which is ideal for graphics because of the integral fire buttons on the ergonomically designed handgrip. **Spectravideo**'s design team also had the foresight to include rubber suckers on the base of the unit. This means that I can anchor it firmly on my desk leaving one hand free to manipulate the keyboard selected modes of my graphics package. If £12.99 (£13.99 for C16/Plus4) is too much for your budget, there is a less expensive version, ***The Quickshot II***, for just £7.99 (£8.99 C16) which also sports suction feet.

The way a joystick program operates is to check the value of memory location 56320 (DC00) for Control Port 1 or 56321 (DC01) for Port 2. These locations correspond to two bytes on the MOS 6526 complex interface adaptor (CIA). The joystick's connection plug doesn't actually use all nine pins of the socket because only six are required; one for each direction (four connections), one for the fire button and an earth connector which grounds the pin which is currently switched to on by the joystick's movement.

Inside the C64, the movement of the stick can be detected by reading the lower four bits of register 56320, the fifth bit being the fire button detector.

Direction	Value
North	**1**
South	**2**
West	**4**
East	**8**
Northeast	**9**
Southeast	**10**
Southwest	**6**
Northwest	**5**
Fire	**16**

The easiest way to read the joystick from Basic is through the WAIT command using the form *WAIT a,b,c*. For Control Port 1 the value of *a* is 145 and for Port 2 its value is 56464.

To test for a direction the values of *b* and *c* are both the same. So to test for an upward movement on a joystick in Port A, a sample program would be:

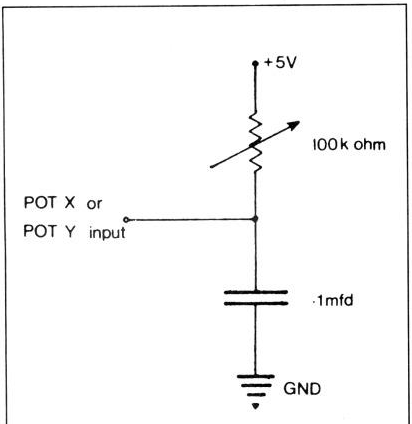
```
10 PRINT"(CLRMOVE JOYSTICK"
20 WAIT 145,31:REM CLEAR THE PORT
30 WAIT 145,1,1
40 PRINT"JOYSTICK UP"
```

Although sampling of the joystick port is possible from Basic, a truly reliable program is best created using an interrupt routine in machine code to test the Control Ports' states. This means that the joyport is tested sixty times a second which is much faster than any subroutine call in Basic could ever be.

Greater Potential

Just as a joystick is many times better than keyboard control, so a potentiometer joystick is better than the normal switched joystick. The reason for the greater control lies in the way it is connected to the computer.

The Control Ports have nine pins, we know that six of these are used by the standard joystick but there are two special pins which give access to a special facility known as A/D, or analogue to digital, conversion.



Potentiometer joystick circuit.

An analogue signal is one which constantly varies, a digital one varies in finite steps. The potentiometer joystick creates an analogue signal through a variable resistor (potentiometer) which gradually allows more or less voltage to pass as it is rotated, rather like a volume control increases and decreases sound.

Movement on the screen can be broken down into two components, vertical and horizontal. Accordingly, the joystick contains two potentiometers ingeniously linked at 90 degrees to one another so that the amount of stick movement in any direction causes rotational movement of the potentiometers which reflects the degree of the two components of the movement. This increases and decreases the voltage through each over a range from zero to five volts.

A single byte can store any whole value from 0 to 255 but with no decimal places. The voltage must therefore be made to trigger the byte to jump one value as every 20 millivolt change is detected. This analogue to digital conversion is achieved by a special section of the SID chip. The values recorded for the horizontal and vertical component can then be used to pinpoint a specific position on the screen.

The external circuitry for this control is shown in Figure 1 but remember that there are two identical circuits in each stick. These circuits connect through pins 5 (vertical component) and 9 (horizontal component) on the Control Ports. The pins are indirectly connected to the SID chip locations 54297 and 54298 and their values should be 128 when the stick is in its central rest position.

A mouse works on the same principal but resembles a trackerball turned upside down with two buttons placed on the top surface. These two button'eyes', plus the fact that it runs about

the table with a long'tail' of connecting cable trailing behind, earned the unit its name. Mice can be totally controlled by one hand and frees the other hand for operating the keyboard. Many people seem to dislike mice when they first use them but after a while they find these delightful little creatures have become totally indispensable.

Light Works

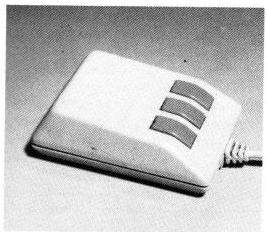
Watching someone using a lightpen is very like watching a traditional artist at work. The sheer magic of passing this hi–tech wand over the screen and creating an effect is impossible to describe. Apart from anything else, how does the computer know where to make this mark?

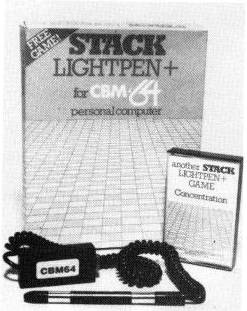
Lightpens pinpoint their position through principles similar to those employed by the potentiometer joystick and the mouse but each location is derived by a totally different method sensing system.

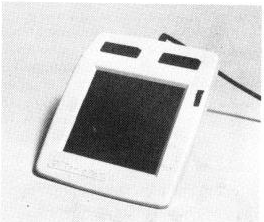
A TV picture is created by a stream of electrons being beamed across the screen in a regular pattern of 625 lines (a raster scan). The screen is treated with a special coating which emits light according to the strength of the beam of electrons which hits the screen and fades slowly enough for it to maintain a reasonable output until the next scan. If a sensor is placed in front of a point on the screen it can detect the moment that the scan passes by.

A lightpen contains one such sensor and, because the scan is controlled by the computer, the position of the pen can be accurately located. By peeking into memory locations which keep track of the beam scan, the horizontal and vertical placement of the pen can be calculated.

This is the theory but the practice is a little less accurate than it could be because of the way in which the VIC chip operates. The Y–axis (the vertical position) is measured to two pixels of accuracy but on the X–axis this is reduced to four pixels. What this means is that you don't get pinpoint accuracy with a lightpen and software has to compensate for this with Zoom facilities and the like.







The components for the screen position can be read from locations 53267 (X component) and 53268 (Y component). Obviously accuracy will further be affected if these locations are read from Basic because of the time delay involved in reading the two locations.

To help software programmers, a switch or trigger of some kind is also included on the pen so that software can be informed of the exact moment when a point is to be plotted. This trigger is connected through the same pin which is used for the joystick fire button on Control Port A only.

The Plot Thickens

Potentially the most useful art peripheral is a graphics tablet like the famed ***Koala Pad***. This is another way that computer art can approach the traditional pen and paper approach. Simply by tracing out a shape with a stylus, a faithful reproduction can be produced on the screen.

The pad is crisscrossed with a pressure sensitive matrix covered by a rugged but yielding surface. Ideally there would be a crosswire at each pixel location but once again the limitations of the computer's electronics inhibits such pixel point accuracy.

Access to the output of the pad is achieved through the same pins used by the mouse.

Shoppers' Guide

Several companies produce mice for the C64/128 and anyone buying the special 64C pack will find the ***Neos*** mouse and its accompanying ***Cheese*** software inside the box. Those who wish to buy the Neos package will find it widely available but anyone having problems can buy the mouse and software from **Stack Computer Products** for £24.95 on cassette or £29.95 on disk. Their own ***Stack Mouse*** may seem a little expensive at £35.00 but it has three trigger buttons and an X–Y axis lock for greater control.

The ***AMX Mouse*** from **Advanced Memory Systems** also features three buttons and the package costs £69.95.

Wigmore's produce the ***MS2000 Mouse*** for £64.90 which includes their *Artist 64* cassette software. Disk owners will have to fork out an extra £3.50 for their copy. The mouse has a special function, if the computer is powered up while holding down one of the two mouse buttons it can be used like an eight–directional, switched joystick.

With a price tag of £24.99, the ***Datel Mouse*** may seem the most economical of the three–button mice but it doesn't have any software support included in the price.

The first lightpen I ever saw was the ***Stack Lightpen***. It's around today and still costs only £28.00 which can't be bad especially when you consider that you get a graphics package and ten games.

Trojan's lightpen is another old trooper with a great reputation. Rather than sell a graphics package as a backup to the lightpen, this is a lightpen which backs up the Cadmaster software. There's more good news because the C16 version costs exactly the same as the C64 one, £19.95, which by any standards is excellent value.

Another package offering a free lightpen is ***Blazing Paddles*** from **Datel**. Blazing Paddles is an impressive software package and at £24.99 with a lightpen it is a bargain which is hard to resist.

When it comes to potentiometer joysticks and graphics pads the range becomes extremely limited. The Koala Pad has not been available over here for some time but may occasionally turn up in second hand offers and should be snapped up immediately. Beyond this I know of no other pads specifically designed for the Commodore market.

With potentiometer joysticks the outlook is not so bleak but can hardly be described as rosy! **Stack Computer Products** stock the ***Revs Analogue Joystick*** for only £10.95 and many of the Japanese MSX standard joysticks were produced with potentiometers inside but their leads would need modifying to suit the Commodore socket. It's best to stick to the Japanese manufacturer's makes such as **Toshiba, Pioneer or JVC** because all of the British made joysticks are standard switch–operated types.

Missing Feature

Whatever you decide to buy for your graphics aid, there's no getting away from the fact that you'll have to buy a graphics package to supply the correct on–screen environment. If you're going for the exotic options such as a lightpen then go for a fully inclusive package of pen and software. If you don't like the software in the package, you can always buy a suitable package later on.

Whatever your final decision may be there is an extra facility which you'll need that isn't supplied on any of the software menus I've seen...*talent!*

A La Cart

It's taken five years but the cartridge revolution is here. Now the only problem is to find the one tailored to your needs.

by Tony Hetherington

The Commodore 64 is in a class of its own when it comes to utility cartridges. The BBC has its ROM chips but the C64 owner need only plug in a cartridge to speed up disk access, add a range of useful utility commands, create a screen dump, freeze a game to create a cheat version or, in my case, take a magazine screenshot and dump programs from tape or disk onto another disk or tape in a compact form allowing you to pack more games on one disk.

Some cartridges contain routines to backup commercial software which should only be used for personal use. I accept the right of an individual to backup his own games and convert them from tape to disk (instead of paying again for a disk version of the same game) but I must condemn any attempts to use these devices for software piracy.

Piracy robs the software house of its profits and the programmer, designer and graphic artist of their royalties and as a result is pushing up software prices. This will affect everyone and may eventually deprive the honest users of devices like these of a useful utility.

The current trend towards packing game boxes full of booklets and play aids may counteract this form of theft and will ensure that pirate copies will never be quite the same as the original.

Before we look at the amazing range available I'd just like to remind everyone that cartridges should *never* be plugged in while the computer is powered up. You may get away with it once or twice but it's a sure thing that your computer and possibly the cartridge will come to grief eventually.

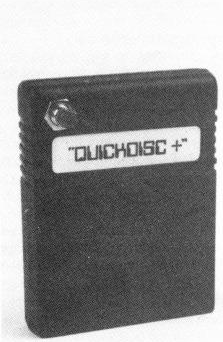
Most of these cartridges are available from mail order houses and good computer shops but some may take a little more effort to track down. I would like to thank Microsnips (37 Seaview Rd, Wallasey, Merseyside, L45 4QN) for their help in supplying some of the cartridges mentioned in this article.

Quickdisc+ / Evesham Micros / £19.95

This cartridge provides a LOAD/SAVE facility that's 5 times faster than the normal 1541 snail's pace plus a variety of other utilities.

The cartridge has a large red reset button within easy reach. This button will break into any program that has locked up the C64 and using the OLD command you can then retrieve your bugged Basic program.

The reset button may be the most visible benefit and the faster LOAD/SAVE ability the most used but the cartridge



also contains a selection of commands accessed through two key presses or one of the function keys as well as a cure for the'save and replace' bug.

Formatting a disk is a quick and simple task with Quickdisk II. Instead of typing in a laborious command and then having to wait for over a minute while the drive hammers away, *%N0:disk name,ID* formats the whole disk in just 20 seconds! Pressing F7 displays the disk directory which can be paused at any stage by pressing the space bar. It's also as easy to scratch, rename or copy a file or to validate, renew or initialise a disk.

Programs that are loaded in at 5–7 times faster (you won't appreciate this until you've used it) can be loaded to a file address or into Basic where it may even be autorun.

If you've got a disk drive and you can't afford something like Dolphin DOS then you might like to pick up a copy of Quickdisc+.

The Final Cartridge / H&P Products / £39.00

The Final Cartridge has a freeze utility that can backup software and generate screen dumps, Basic extension commands such as DLOAD and AUTO, software to support Centronics interfaces, preprogrammed function keys, 24K of extra RAM and a disk or tape turbo that loads programs 6 or 10 times faster.

When the C64 is switched on or reset via the cartridge button, a menu is displayed from which you can call up a comprehensive machine code monitor; disable the cartridge; turn on the cartridge ready to load or create a program; save to tape or disk; or printout a screen dump.

The Final Cartridge also contains a selection of toolkit commands that will make programming much easier. AUTO generates line numbers ranging from a specified number by a set increment value with the default settings producing line numbers 10,20,30 and so on. RENUM reorganises your programs (including GOTO and GOSUB commands into tidy line numbers. DEL deletes a block of program lines. FIND lists every line in which a selected string of characters appears. HELP highlights bugs when testing programs. With APPEND and DAPPEND you can add routines into your programs that you have previously saved.

Disk users will appreciate the following commands that speed up disk housekeeping tasks and display disk directories (as an alternative to pressing F7), load a program , format a disk, or SAVE and VERIFY a program in the computer's memory.

Tape users, who are often left out of the fast loader scene, will relish the tape turbo that can save a program in memory through the normal tape commands but then reload it ten times faster than the normal rate.

The freezer stops a running program so that you can you make backup copies in a compact form but you'll need to use the cartridge to load them back in again. When you reload the program it restarts from where it was when it was frozen so it's important to freeze them at a convenient point such as a menu screen. While a game is frozen you can also disable sprite to sprite or sprite to background collisions. This may stop alien missiles from killing you and give you a chance to get further through the game or it may stop *you* from killing *them*! It all depends on how the programmer wrote the game. Well, you didn't expect cheating to be that easy, did you?

While a game is frozen you can also dump a screen to a printer, either a serial Commodore printer or one connected by a Centronics lead, supported by the interface built into the cartridge. The screen dumps can be printed in two sizes and feature full grey scaling for coloured images but the finished result won't contain any part of the screen sprites as these aren't supported by the routine.

Finally, the cartridge also includes a full machine code monitor that can be used to fill an area of memory, compare to blocks of memory, print out a block of machine code and directly manipulate blocks of information stored on disk by using sector read and write commands.

The Expert / Trilogic / £29.99

The Expert cartridge is probably one of the most comprehensive cartridges available. Because the internal chip is RAM rather than the usual ROM, it can be readily updated to cater for the latest programs simply by buying a new disk for a fraction of the original cost of the cartridge.

As soon as you see the Expert you notice something is different because it houses a reset button, a three way switch marked

ON, OFF and PRG, an if–all–else–fails button and LED.

Much of the Expert disk contains files that either contain the information to transfer a difficult or multi–load game or offer routines to add extra lives and other cheats before making a backup. The saved backup is then compacted so you can get 2 or 3 games on a disk which each reload within 30 seconds.

The disk also contains a full monitor with a printout facility and a series of utility routines including ones to alter, edit or disable a game whose sprites may be of particular interest.

A lot of games use sprites which are animated to create the movement of critters, monsters and missiles that are out to maul you. The Sprite Extractor routine enables you to freeze a program, display it's sprites, view their animation and then save them to disk. A separate sprite editor on the Expert disk (which doesn't work with the Expert cartridge) can be used to edit or customise sprites for use in your own games or to load them back into a frozen out version of the original.

The Sprite Immortaliser can disable sprite to sprite collisions and or sprite to background collisions. This could save you a lot of lives as these are the collisions which usually kill you but this may also block the effects of your firing back, leaving you helpless.

The hi–res grabber and picture saver routine can be used to grab any frozen hi–res screen and save it to disk. This saved screen can then be converted by another utility into a Koalapad formatted screen and edited and printed as normal. However edited hi–res screens cannot be loaded back into the original game.

If the cheat files don't work or there isn't one for the game that currently foxes you, then the method may be listed in the cheat machine section which describes how to freeze the game, list the code and alter the relevant lines. This cheating aid is just one function of the Expert's full machine code monitor which is completely invisible to the user and can be used over the full 64K of memory. It can be used to access both Basic and Kernal ROMs and it's typical functions are to inspect a program, alter a program, to list any part of a Basic program, to write a machine code program, as a hex to decimal convertor and to search for data, addresses or text.

Cassette users can get a special version of the Expert. It's the same cartridge but is programmed from a tape which includes tape to tape transfer utilities.

Loading from disk or tape each time you power up may sound laborious but it only takes a few moments and allows easy and inexpensive updating.

The Freeze Machine / Evesham Micros / £28.95

The Freeze Machine is a bright red cartridge with two buttons marked RESET and FREEZE. The Freeze function obviously freezes programs ready for saving to disk but the Reset button is used to toggle between the menus for Freeze Frame Mk V and Lazer Mk II both of which have been brought together on this cartridge.

The Freeze Frame menu allows you to turbo load and save some commercial programs as well as your own development programs in a fraction of the normal time, typically 20 to 40 seconds. This may not sound like a great time saving but can make a big difference to a program such as a word processor or database which is used everyday. You'll realise the difference if you ever have to load them at normal snail's pace after you've been using the cartridge for a few weeks.

Freeze Frame also includes a Game Killer utility to disable sprite to sprite and sprite to background collisions plus utilities to fast format, initialise and validate a disk, display the directory and to rename or scratch a file.

The Freeze Machine also includes the Lazer II system which saves frozen programs as USR files that can be loaded back in 18 seconds or less! Lazer files can't be scratched (the whole disk must be formatted to remove them) so your disks could become cluttered with unwanted files.

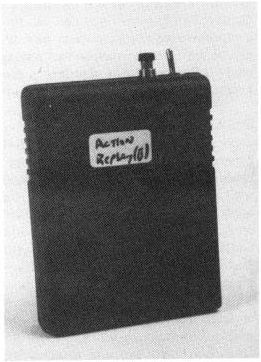
The Lazer system has a similar set of utilites to those with Freeze Frame plus extra one to convert PRG files to USR format.

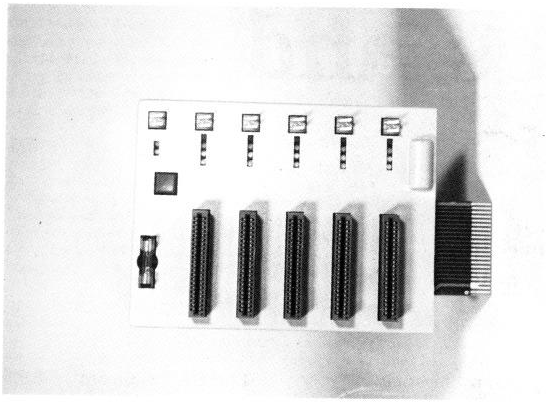
The Freeze Machine is ideal for programmers who need to save development programs in seconds but

they will miss the machine code monitor facility which is supplied in most of the other cartridges.

Action Replay / Dosoft / £29.99

Action Replay combines any combination of disk and tape transfer that you can imagine. It is also capable of backing up multi–load programs and has a sprite controller, fastloader, code inspector and picture save utility.





The backup utility is easy to use and produces a compacted, fast–loading version of any frozen program. The final copy usually occupies 220 blocks, so three games can be compacted on one disk and reloaded up to five times faster than normal by flicking the fastload switch on the cartridge.

The Sprite Controller allows you to disable sprite collisions and save, edit and replace customised sprites into any game.

Any multicolour hi–res screen can be frozen, grabbed and saved to disk and formatted for the Koala Pad or Blazing Paddles graphics packages and then they can be edited, mixed with other graphics and printed out.

Although Action Replay lacks a full monitor it has a code inspector that, at a press of a single key, will display the current contents of the Program Counter along with those of the IRQ and NMI vectors, 6510 on–chip registers, Vic II chip IRQ mask, the raster–compare latch value, the CIA ICR mask values and timer latch values. Four options are then available: to load in a full monitor or load and execute a machine language program, jump to any address in memory, display a block of memory, or return to Basic.

Dosoft also have a version of Action Replay combined with Diskmate II which includes a 10 second formatting routine, single keystroke disk commands and a toolkit all for £39.95.

Mother Load

With all these cartridges around you may well find yourself plugging and unplugging them from dawn till dusk. It won't be long before the cartridge port starts to wear out with all this activity so why not invest in a motherboard for your cartridge slot before it's too late?

Cardboard 5 / Precision Software / £30.39 (plus VAT)

This board has slots for five cartridges which can be switched in and out as required. A fuse and a reset button should prevent any mishaps and a bank of LEDs for each slot shows you which cartridge is currently in use.

Datel Motherboard / Datel Electronics / £16.99

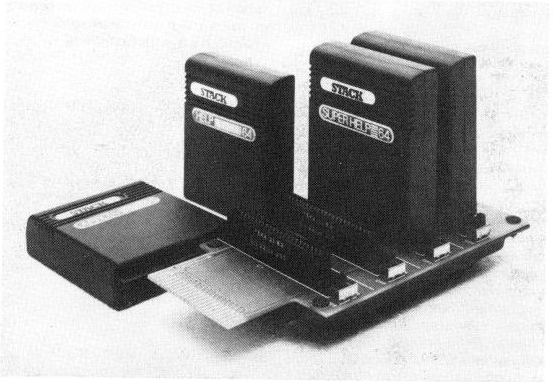
The Datel Motherboard has three slots for cartridges, a safety fuse and a reset switch but no LED indicators.

Evesham Motherboard / Evesham Micros / £28.00

A useful little board that comes in two varieties. One has four vertically mounted cartridge slots but the other only has three with a handy through socket to fit a modem.

Stack Motherboard / Meedmore (Distribution) / £28.00

A four–slot, switchable motherboard with an optional modem slot facility.



Fixtures and Fittings

A plethora of peripherals are available for all manner of specific jobs. Can you afford to be without them?

By Tony Hetherington

Some add–ons and accessories can't easily be categorised. They're not a disk drive, printer, monitor or graphics tablet but they're just as useful. For example, how can you use a printer in a busy environment without a stand to put it on with paper stowage underneath it? How are you going to play a game without a robust joystick or safely store your disks without a disk box?

Add to all this devices which double your disk capacity; stop your drive from hammering itself to pieces; generate teletext on your monitor; quickly and efficiently back up tape data files; or keep things generally running smoothly, and you have the measure of the range of auxiliary equipment available.

INTERACTIVE DEVICES

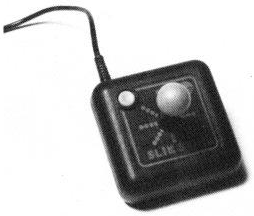
Interactive devices include any form of joystick, mouse or related device. Beginning with the essential joysticks themselves, there is an incredible choice for the potential buyer.

Matching the right joystick to the right type of game is essential as the wrong stick could cost you that high score. As a general rule you get what you pay for; a higher price generally means a faster more responsive stick with a quicker and more accurate means of gauging movement. As well as this the higher price range often brings refinements such as shaped, ergonomic sticks frequently with extra fire buttons.

Economy Joystick . Suncom . £5.99

This is the basic Atari joystick that I still favour. It's cheap and cheerful but not particularly quick nor will it withstand the constant battering of decathlon–style games. Having said that, Suncom is prepared to offer a one year guarantee and you can buy replacement switch boards when the bubble switches eventually wear out. In my experience, all my Suncom sticks have parted company with their bodies long before the switches failed.

The Economy joystick is also available from other sources but at a variety of prices as it was first introduced as part of the Atari VCS video game system. It's a basic joystick at a basic price.



Slik Stik . Suncom . £6.99

The best way to describe the Slik Stik is to say that it's small! A curved base makes it easy to hold and it has a ball top handle for an easy grip. There is very little play in the stick t he distance the stick is moved to make a contact making it ideal for rapid movement games.

Starfighter . Suncom . £9.99

The Starfighter is described as the 'ultimate joystick' but is little more than an updated version of the Slik Stik with a column handle. Commodore PC owners should also note that there is a ***Starfighter IBM*** **version that features an extra fire button and a £24.99 price tag. All versions carry a two year guarantee.**

TAC 2 . Suncom . £10.99

The TAC 2 Totally Accurate Controller is a tough all–action stick. The steel shaft will take almost any punishment and delivers the joystick movements to the steel contacts with the minimum of effort. The TAC 2 features a ball handle and a second fire button that gives left handed players a look in.

TAC 3 . Suncom . £12.99

The TAC 3 reshapes the micro switch

TAC 2 and gives it a pistol shaped handle and three fire buttons. Two buttons are on either side of the base and the other on top of the handle. If you still can't hit the target with three buttons then the joystick isn't your problem!

TAC 5 . Suncom . £13.99

The top of the Suncom range, the TAC 5 offers a pistol handle, three fire buttons and audio feedback! That means it clicks when you push it so that know when you've made contact. Ideal for games where precision is the key.

Speedking . Konix . £00.00

Shaped to fit snugly in the right hand, the Speedking has a small, audible contact shaft with accurate movement. It's designed to fit neatly into the hand so that the index finger hovers over the fire button. If it doesn't fit your hand then look elsewhere, if it does fit then it will give reliable service. It's up to you to do the rest.

This is one of the few joysticks currently being produced with a C16. Plus4 connector.

IconTroller . Suncom . £19.99

Users with more serious applications in mind and who only need a joystick to select icons, for example in GEOS, will appreciate the smart approach of the IconTroller. It's a mini joystick that sticks onto the right-hand side of a C64 or C128 keyboard and plugs into either joystick port but has a second nine-pin port and consists of a mini stick and a shaped fire button.

Magnum . Mastertronic Ltd . £12.50

A variation on the joystick theme is provided by the Magnum's pistol grip design. The short stick moves in a very positive way with quite a strong return spring. The rear mounted fire button is ideally positioned for the thumb making this stick superb for purposes where slow, accurate movement is required, but not very comfortable for rapid action shoot-em-ups.

AMX Mouse . Advanced Memory Systems . £69.95

The AMX mouse is the deluxe model of the Commodore mice and features three buttons which makes it ideal to use with the Stop Press desktop publishing software.

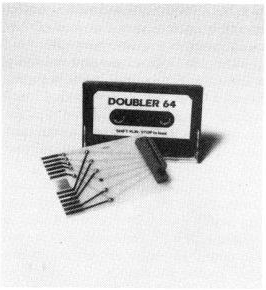
Neos Mouse . AMS . £27.95

Bundled with 64C or available separately with tape or disk driver software the Neos mouse is the cut price version offering only two buttons and little software compatability.

TAPE TREATS

Doubler . Evesham Micros £12.95

The Doubler is a very simple device that plugs into the cassette port and allows tape to tape backup of data. Two cassete decks are connected to the input and output sockets and the transfer is then controlled by the accompanying taped program.



Load-It . Load-It . £19.95 £ 7.95 kit

The Load-It kit provides a versatile and effective answer to most loading problems. These problems are usually caused because the machine that recorded the program has a slightly different head alignment than your datasette. This is why you might be able to load the game on your friends computer but not your own.

The Load-It device replaces the head alignment screw with a knob that can adjust the position of the tape head azimuth alignment; a graduated scale so you can note the settings that work for your favourite games and a piezo electric speaker so you can hear when you get the clearest signal. If the tape still won't load then the chances are that it never will.

DISK KITS

Dolphin Dos . Evesham Micros . £69.95

Dolphin Dos is quite simply *the* disk operating system that Commodore should have installed in the C64 and the C128.

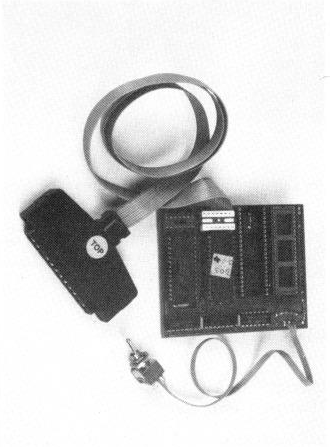
If you're confident about desoldering then you can fit it yourself but if you're not then get someone else to do it for you because you could cause a lot of damage.

Once it's installed, both in your computer and the disk drive, you can switch Dolphin Dos on and off from

switches on both units and have a parallel operating system that can load a 200 block program in just 5 seconds!

Dolphin Dos can also save and verify a 200 block program in 10 seconds, format a blank disk in 20 seconds T2 secs without VERIFY and speed up the loading and saving of sequential and relative files by up to 8 times the normal 1541 snail's pace.

Even if you find a disk that isn't compatible with this high speed DOS, you can switch it off at the drive but keep it switched on in the computer allowing the use of the extended operating system's easy to use commands. For example, pressing RUN.STOP becomes the equivalent of LOAD "£",8,1. SAVE and REPLACE, Dolphin Dos style, works faultlessly and programs can be loaded from a disk directory or listed on a printer at the press of a key!



1541 Quiet Drive Stops . Evesham Micros . £4.95

A cassette tape containing one short utility program, an instruction card, two washers and two metal clips may not seem

much but this kit will reduce the chances of your disk head creeping out of alignment and stop that hideous hammering noise.

The disk head 'hammers' as it hits the rigid stop when orientating itself or with some commercial disk protection systems. The kit replaces the normal stop with a flexible spring stop that reduces the hammering sound to a purr and cuts out the jarring that can knock the head off alignment.

Supplying the control program on cassette may seem strange but it's perfectly sensible since your drive might be so out of alignment that it can't load a disk! The kit can quieten two drives.

1541 Physical Exam . Evesham Micros. £39.95

The performance of any mechanical equipment deteriorates with age and a disk drive is no exception. In time the speed will vary outside the safe limits and possibly the alignment will drift. Correction is relatively simple but may cost over £30.

Evesham's Physical Exam is a high quality product which will detect all types of error which may occur with the disk drive. After its first use the kit will have paid for itself and after that you'll be in pocket.

Head Cleaner . Suncom . £5.99

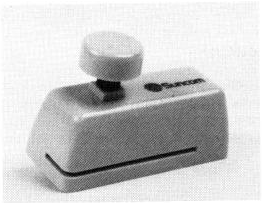
This is the disk equivalent of an audio tape head cleaner. The cleaning disk and bottle of solution is enough to spruce up your drjve head 15 times and helps to reduce read errors and, in bad cases, will avoid physical damage to your disks.

Amiga owners will be interested in the 3.5 inch version that costs slightly more at £6.99.

The Notcher . Suncom . £4.99

This amazing hole puncher can save you money and disks. All it does is to punch a second, correctly registered write protect notch allowing you to use both sides of a disk.

Although some disks are sold as single sided, all disks are manufactured as double sided and quality control sorts out the quality rating they are given. All this means is that a single sided disk is not guaranteed to work on both sides, although most do. Obviously, it's essential

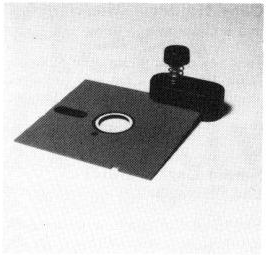


that you try the disks before you save the only copy of important data or only use this in emergencies.

The Notcher is supplied with a pack of labels and write protect tabs.

Disk Coupler . Computek Microsnips . £4.95

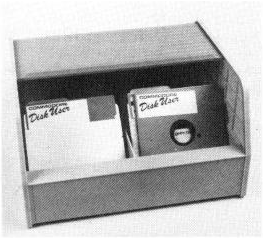
A robust version of the Notcher for heavy handed disk users. This one lacks the catalogue labels of the Notcher pack.



Diskit . Suncom . £17.99 – £25.99

The diskit series is a range of disk boxes complete with a classy roll top lid that swings right over when you open the box and won't fall on your fingers.

Diskits come in either single or double boxes that hold 60 or 120 of your 5.25 inch disks. Both types have an optional lock, hence the range of prices. The bad news is that they are supplied in flatpacks and have to be assembled but, if you keep your cool *and* the instructions, this shouldn't take you more than a few minutes.



Disk Boxes . various makes . £7.50 – £11.70

A disk box needn't cost you as much as the Diskit, the standard type with lift up clear plastic lid is available in a variety of shapes and sizes from an array of companies ranging from Manor Court Supplies box capacity 50 disks – £7.50 and Micromedia box capacity 100 disks – £11.70.

Alarmed Disk Box . Inmac . £39.95

If your disks contain particularly important information and you're worried about burglars then you'll need Inmac's latest burglar proofed disk box. It features a built in movement alarm that screeches at 98 decibels for 15 seconds whenever somebody tries to move it.

IN PRINT

Printer Stands . various makes . £6.99 – £19.99

If you've ever tried to use a printer in a busy room or office then you'll appreciate the need for a stand that neatly stores the paper underneath the printer. Then, for a complete system, you could add a paper tray to collect the paper as it comes off the printer.

Suncom has a wide selection of rigid, wire–framed printer stands from 12 to 24 inches wide that range from £6.99 to £19.99. The Papermate costs £10.99 and is a pair of printer stands which fit almost all printers.

A paper tray which will clip on the back of any wire framed printer stand not just Suncom's adds an extra £11.99 to the total cost.

Micromedia's printer stand is made to fit all 80 column printers and is built from 5mm clear perspex and costs £19.90.

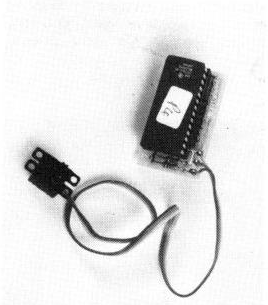
Printkit IV . Avon Printer Technology . £30.00

Not to be confused with the Printer IV the Printkit IV fits into the MPS803 to add true descenders to the original character set. Italic, underline and bold modes are added as well and Printkit speeds up the printer's operation.

Printer IV . Datel . £19.99

The Printer IV is a replacement character ROM for the MPS801 printer that provides the user with four new character sets that can be selected by setting the position of two switches.

Once installed the Printer IV is compatible with all software and will print your text out in either Descender, Eclipse, Scribe or Future characters.



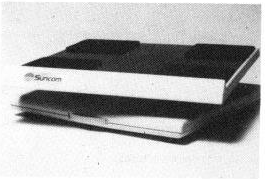
ON SCREEN

Swivel Bases . various makes . £15 – £15.90

Swivel bases or monitor stations are revoloving and tilting platforms that allow you to ensure that your monitor points directly at you when you look at it, taking the pain in the neck out of computing.

Suncom's Monitor Station £15.99 supports monitors with a screen size up to 14 inches and has a locking action so you can keep the right setting once you've found it.

Micromedia has a choice of two sizes of swivel base one for 12 inch monitors £12.00 and a larger one for 14 inch screens £15.00.



Glaredown . Suncom . £17.99 – £19.99

Available in two sizes and prices the Glaredown is am anti–glare screen that fits over 12 inch or 14 inch screens. They effectively ease eyestrain by reducing glare from sunlight and overhead electric lighting, rendering the screen easier to read.

VIDEO ON

ComputerEyes . Stem Computing . £119.00

The ComputerEyes Video Aquisition System converts a video picture from either a good video recorder or preferably a video camera into a format that can be stored and used by your C64.

The unit plugs into the user port and is connected to the video source via a video cable. The scan begins at the press of a button and takes about six seconds for a full grey–scale image to be stored on disk.

ComputerEyes is controlled by a menu driven control program that can supplied with additional disks to allow the captured picture to be converted into Koala Pad, Doodle, Flexidraw, Print Shop or Newsroom formats.

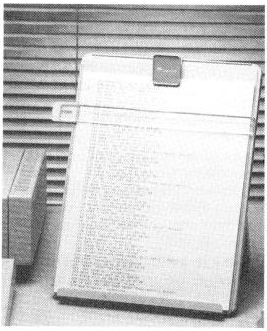
Teletext Adaptor . Microtext . £69.95

By using the TV modulator built into a domestic video recorder and the display abilities of the C64, Microtext has produced a teletext adaptor for a fraction of the normal cost.

By connecting the video to the plug in adaptor via a 20 metre cable you can get a superb teletext picture on your computer screen. The dapator continuously updates and improves the page on screen with the result that the picture is even better than on a teletext television!

Now you can check on the weather in Tokyo or find out what's on at the local cinema, check the road reports and then store any of these pages of information on disk and print them out later.

You can also write your own BASIC programs to read in teletext pages and use the information in them for such purposes as a football pools predictor database or to plan your next move on the Stock Market.



MISCELLANY

Documate 2 . Suncom . £12.99

The Documate 2 is a free standing document holder complete with clipboard and adjustable ruler to ease the typing in of listings.

Copy Holder . Micro Media . £13.90

The Copy Holder is an adjustable version of the Documate 2 but also contains a clamp to fasten it onto the edge of a table.

Smart Cart . Datel . £14.99

The Smart Cart is a battery backed 8K RAM cartridge onto which you can save or load almost any program you require. After loading the program into the cartridge you then flick a switch to keep it in instant cartridge recall format for up to five years.

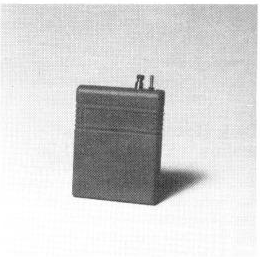
There is also a larger 32K version 4 switchable 8K banks that costs £29.99.

Reset Cartridge . Datel . £5.99

This is simply a reset button that halts programs so you can type in extra–life pokes.

Cartridge Development System . Datel . £12.99

This kit contains all you'll need to build your own autostart cartridge and includes a 16K Eprom, PCB, reset switch and red plastic cartridge case.



Heavy Metal Hardware

If music be the food you love then read on

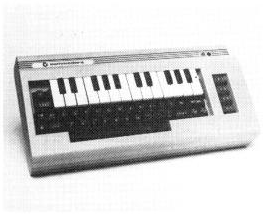
The Commodore 64 and 128 may have the best sound chip of any eight–bit computer but this doesn't make either of them the ultimate music machine. There may come a time when you get a touch of the Oliver Twists and decide that you want more, which means plugging in external music hardware to get a greater range of sounds with more control over them.

Music add–ons fall into one of three categories: external sound generators, sound samplers, and MIDI interfaces with their associated software. Each category extends the capabilities of the C64/128 but the basic talent must be provided by the user. Music extensions bring the world of Beethoven, Britten and the Beatles within the reach of the common man without the physical dexterity necessary to play like a virtuoso performer.

Using the Commodore with music hardware and software can turn it into a new machine which not only provides hours of entertainment but can also be used as a powerful music theory teaching aid.

Sound Generators

These provide an alternative to the sounds generated by the SID chip, adding more and better sounds thereby opening up a wider range of possibilities for compositions and arrangements.



The ***Commodore Sound Expander*** (£99.99) falls into this category, bringing FM synthesis to the Commodore. Apart from eight channels of sound you also get rhythm generation, auto accompaniment, single finger chords and a riff sequencer amongst many other facilities.

FM (frequency modulation) synthesis was pioneered and popularised by Yamaha with their range of DX synthesisers. Through FM many sounds and instruments can be accurately duplicated as well as many new and unique sounds.

The cassette version of the Expander contains 12 preset voices but the disk version carries twice that number. Altough tricky, it is possible to create and edit your own FM voices but the Expander package does not allow you these facilities which means that you could miss out on a lot of the potential of FM music but help is at hand.

For an extra £29.95, the ***FM Composer/Editor*** gives you simplified editing control over the Expander's voices, provides a voice library system, and the Composer part of the software lets you create and store your own compositions. I would certainly recommend that anyone who buys the Expander should also budget for this.

It's possible to play the Expander from the Commodore's QWERTY keys but if you find that too awkward – and it is! – you'll at least need the ***Music Keyboard Overlay*** (£9.99); a plastic piano–style, clip–on keyboard which fits over the relevant computer keys. If you want a more professional keyboard there's the five octave ***Full–size Keyboard*** (£79.99) which is ideal for those with previous keyboard experience.

At this point it's worth mentioning ***Music Maker II 64*** (£19.99) and ***Music***

Maker 128 (£24.99). These both contain the Music Keyboard Overlay and programs which help you to play and record using the SID chip as the sound source. Both sets contain ten preset sounds and you can record tunes using the *SFX Easy Play Sequencer* ***and*** play them back with or without rhythm backing.

If this idea appeals to you, you can also buy three Playalong albums for £9.99 each: *Popular Classics*, *The Beatles* and *Pop Hits*. The albums include a disk or cassette and a music book with hints and tips about playing.

The ***Sound Studio*** (£14.99) is subtitled 'a Professional Synthesiser and Recording Studio'. While I doubt if even Trevor Horn could make a hit record with it, you do get a pretty good introduction to both the SID chip and the recording process. The package is split into two parts: the Synthesiser and the Editor.

The Synthesiser gives a brief rundown on sound, pitch, timbre, volume, vibrato, portamento, ring modulation, synchronisation and SID's filters.

Using the Editor you can enter music in real–time or step–time. Music can be recorded on three tracks, or six if you have a MIDI interface but you'll need a synthesiser (or two) if you want to play back these extra tracks.

The Sound Studio can be played using the Keyboard Overlay, using a MIDI interfaced keyboard or from the Sound Expander's Keyboard. See how it all ties up?

Everything mentioned so far is available from Music Sales, although many other shops and mail order firms also stock them. There is a special package called the ***Commodore Music Expansion System*** which contains the Full–size Keyboard, Sound Expander and Sound Studio, all for £149.99 – a saving of £44.98. Shopping around could save even more because the CME System has been advertised for less than £80 recently.

Sampling Sounds

A sampler is a device which "listens" to a sound and converts it into bytes stored in the computer's memory (a process known as digitisation). The problem is that samplers eat RAM like bunnies eat lettuce and in order to produce clear sampled sounds you need to store lots of bytes – and that means you need lots of RAM. How useful to have a computer such as the Commodore with lots of RAM waiting for bytes to be stored in it. Despite this, you still have to trade off available RAM and sound quality.

Jargon time I'm afraid. In connection with sampling you'll hear terms such as sampling rate and bandwidth. Put simply, the larger the bandwidth and the faster the sampling rate, the better the quality of the sample – and the more RAM it will use. Most samplers let you alter the sampling rate so you can choose the optimum value for the sound you want to digitise. With speech, for example, you can often get away with a relatively low sampling rate. Drum sounds are generally pretty short and can also be recorded at low speeds without too much loss of quality. We'll come back to drum software later.

In order to turn sound (analogue quantities) into numbers (digital values) and back again, samplers use an ADC, not surprisingly standing for Analogue to Digital Converter. This is the hardware part of the package and the quality of the sound will also depend on the quality of the ADC.

The ***Commodore Sound Sampler*** (£69.99), from Micro Sales, plugs into the cartridge port and comes complete with its own software and a microphone. It gives you 1.4 seconds of sampling time at 20kHz which means pretty good quality. You are then given a graphical representation of the sound which can then be altered in several simple ways.

Four short samples can be stored at once and played back on a 16–note sequencer. Sounds can be reversed, looped and played back at different pitches. Special effects include echo with variable delay and a harmoniser which does funny things to instrumental sounds and can make you sound like a robot with a sore throat.

The Sound Sampler is MIDI compatible (although a MIDI interface is not supplied) or it can be used with the Keyboard Overlay.

Datel also have their ***Sampler*** which works out a good deal cheaper at £49.99. A microphone is also supplied with this package and it has MIC and LINE–IN sockets with feedback control.

You can alter the sampling rate (the trade off), mix samples, play them backwards and loop them. It has ring modulation and echo facilities, too. The screen display shows the waveform which can be split into eight sections so you can store eight samples in memory at once. Pieces can then be recorded and saved through a simple sequencer.

Samples can played on the QWERTY keys and the package is MIDI compatible – try Datel's own MIDI interface.

The top Commodore sampler is the ***Microvox Sampler*** available from Supersoft at £229.95. Software is on disk but a Pro version with extra features is available on a cartridge for an extra £70.00. Both versions are MIDI compatible.

The program is controlled through a series of menu pages and offers eight sampling rates. The waveform can be edited by placing coloured flags at the editing points and the sound can be run through companding to reduce aliasing (unwanted noise). The Pro version also contains an Auto Looping Tool which tries to find glitch–free loops.

You can store up to 26 samples at the same time and a small sequencer allows you to program up to 24 patterns, rather like a drum machine, but you are limited to 4/4 time and the samples can only play monophonically (one at a time). The speed of the sequencer can be controlled by an external MIDI clock.

If you want to process incoming sound, the basic model has a digital delay and the Pro cartridge includes harmonising, flanging, phasing and modulation effects.

Drum Machines

Producing rhythm tracks has a certain fascination which seems to cut across the musician/layman divide. Percussion instruments are also amongst the easiest to sample – on a limited memory system anyway – purely because they are short (often around a tenth of a second duration) and don't have a large harmonic range. Cymbals are an exception, having a surprisingly wide harmonic range for such a simple instrument.

Datel's ***Com–Drum*** at £29.99 can store eight pre–recorded drum sounds in

memory at once and the output can be channelled through your TV or your hi-fi system. It comes with three separate drum kits with some sounds being used in more than one kit. The quality is quite good, bearing in mind the price and considering that you'd pay over £200 for a dedicated drum machine.

Drum patterns can be entered in real-time or step-time with up to 32 beats per pattern in 4/4 time or 24 beats in 3/4 time. The program can store eight patterns (not a lot) which can then be chained together to form a song. There's an external sync facility for linking through to a MIDI interfaced synthesiser.

The standard Com-Drum software won't let you alter the three drum kits supplied but with the Com-Drum Editor (£4.990) you can rearrange the 24 sounds to produce new kits.

If you already have the Datel Sampler, you can buy the Com-Drum software to use with it and turn your sampler into a drum machine for £9.99.

Slightly more comprehensive and a little more expensive at £39.95 is ***Rhythm King*** from Supersoft. The basic package contains two kits of eight drum sounds but additional kits are available. You can record in real-time or step-time and you can play more than one sound at the same time. Up to 64 drum patterns can be stored in memory and combined to form up to 16 songs.

There are keyboard and joystick options for creating the patterns and the editor is fairly easy to use. When you're satisfied with your composition, the patterns and the songs can be saved for recall at a later date. The Commodore 128 version of Rhythm King runs in 40 column mode.

This drum section would not be complete without mentioning Firebird's ***MicroRhythm.*** Although it's purely a software program, for a mere £1.99 you get 13 sampled drum sounds to arrange into patterns and songs which can be played through the TV or VDU monitor speaker. There is a provision for saving and loading sounds so perhaps Firebird are planning to release other kits in the future.

Stereo Split

If you want to hear SID, sampled sounds or anything else that emanates from your computer a little more clearly, you could take a look at the ***Sound Splitter*** from Trilogic.

The basic version costs £29.95 and gives you a two-channel stereo effect plus reverb. A lead is supplied for plugging the unit into your hi-fi or stereo unit and there's a mono/stereo intensity control.

For an additional £5.00 (ie. £34.95) the ***Sound Splitter+*** gives you a built-in headphone amplifier (you provide the headset) plus balance and volume controls. That should keep both you *and* the rest of the family happy.

MIDI Interfacing

Even if you incline with only half an ear towards music, you are almost certain to have heard of MIDI. In case you haven't, MIDI is an acronym for Music Instrument Digital Interface. It is a set of digital messages agreed upon by musical instrument manufacturers which allow intruments to communicate with each other. This communication takes place via three types of MIDI socket so you can daisy-chain together a number of instruments.

MIDI really comes into its own when used with a computer. Sequencer software enables you to store compositions in the computer in the form of music data. Good quality software will allow you to enter musical notes by either of two systems: you may be able to record in *real-time* ('live' as you play) or enter music one note at a time in *step-time*. The music is stored as a series of numbers so it is far easier to manipulate than an audio recording. Tricks can be merged and you can edit individual notes with a degree of accuracy impossible with an audio tape recording.

To do all this, however, you need a MIDI interface. That's the core of the system but, like a computer,it is useless without its own software, which is what the main body of this section is about.

If you are recording on to a multi-track recorder you will need an interface with a sync-to-tape facility which lays down a click track on the tape. This ensures that all subsequent recordings keep in time with one another.

MIDI can also be used for voice editing. Digital synths are notoriously difficult to program because most of their parameters are figures, a voice editor can give you graphic displays of these parameters to aid programming. A library system then permits you to store voices on disk and this librarian feature alone is usually worth the price of the program.

Most Commodore MIDI interfaces plug into the cartridge port and one manufacture's software *may* be compatible with another's interface. Note this point well: compatibility cannot be guaranteed and the safest course of action is to use one manufacturer's interface and associated software. With the cost of most MIDI software being so high many suppliers will advise on compatibility between products and may even allow you to try it with your own MIDI interface.

In the interests of showing the range of MIDI software, the following list is necessarily brief but most companies will be happy to supply further details about their products.

Soft Choice

Four names, familiar to most MIDI users, are now conspicuous by their absence from the British marketplace: Sequential, SIEL, Steinberg and Dr T. Sequential still have no UK distributor and they don't seem to be particularly interested in getting one. Steinberg and Dr T are no longer distributing Commodore MIDI products although you may still see their products in some shops. SIEL have now closed their doors for good although you may also come across some of their products occasionally, and mention is still made of their interface which was something of an industrial standard.

It's not all bad news though, there are many new companies willing to fill the gaps left in the marketplace.

Although **Cheetah Marketing** don't produce anything specifically for the Commodore, they do stock several inexpensive keyboards which are worth considering as your music set-up expands.

They have four ***MIDI Master*** keyboards: the basic ***MK5*** (£99.95), the ***MK5II*** (£199.95) with pitch bend wheel and patch change buttons, the ***MK5V*** (£247.95) with a velocity-sensitive

keyboard and the ***MK7VA*** (£399.95) with a seven–octave velocity and after–touch sensitive keyboard.

Cheetah are also developing the ***MD8 Digital Drum Machine*** at £139.95 and the ***MS6 Synth Module*** at £249.95 which should be appearing in the shops as you read this.

C–Lab produce their own interfaces and matching software but their software will also run with a Steinberg interface amongst others.

Distributed in this country by Sound Technology, the standard ***C–Lab MIDI Interface*** costs £79.00 or you can buy one with a sync–to–tape facility for £105.

The ***Super Track Sequencer*** (£115) software is basically geared towards real–time input but you can also record in step–time. One major screen shows all your options but for editing you go to the MIDI Event Editor which gives you access to the bits and bytes of the MIDI protocol. It's one of the best–regarded programs on the market and fairly easy to use.

A recent release from C–Lab is a 16–track score–writing package called ***Score Track*** (£210).

Datel produce one of the cheapest MIDI interfaces on the market at a mere £29.99. Although compatible with their Sound Sampler, Datel have no software to drive their interface yet but they claim that it is compatible with most leading software (JMS, SIEL, the Advanced Music System and Joreth). Always check with your software supplier to make sure.

ElectroMusic Research are arguably the world's most prolific producers of MIDI packages and have made hardware and software for almost every popular home computer. Their Commodore 64 interface costs £79.90 and they also produce a link box called ***MIDIlink*** (£34.95) with one MIDI IN and six MIDI THRU sockets for connecting together sevral pieces of equipment.

They only have one software program for the C64, alas, which is the ***Miditrack Performer*** £49.95, an eight–track, real–time polyphonic sequencer with features such as punch–in (no punch–outs though), track merging and transposition.

EMR often have special package deals at Christmas and at User Shows, so phone for current details if you're thinking of buying one.

Jellinghaus (or JMS) have almost bowed out of the market but you can pick up some bargains from Syndromic Music who are currently handling their range. Supplies may be limited, however.

The ***JMS RMS 2H Interface*** (£29.95) was made for them by SIEL (now defunct) and has a MIDI IN, a MIDI THRU, three MIDI OUTs and an external CLOCK–IN.

The ***12–Track Recording Studio*** is a real–time package which holds velocity, after–touch, pitch–bend, and patch change information. It is quite easy to use once you discover how it works because the manual could be better. Despite this it's still a bargain at £24.95.

The ***Sequence Chain Program*** (£19.95) allows sequences to be linked to produce changes in time, signature and tempo.

The ***Scorewriter*** (£79.95) comes on EPROM and contains three programs: the 12–track Recording Studio, the Sequence Chain Program and the Scorewriter itself.

The package produces a hard copy of your music, including the lyrics but you may have a lot of setting–up to do to get the results you want. The manual could be better but the printed notation is very good.

The ***SixTrack Sound Editor*** at a mere £10.00 is a voice editor for Sequential's SixTrack and MAX polysynths.

JMS also have a very simple ***DX7 Voice Editor*** for the Yamaha at £19.95. **Joreth's** eight–track ***MCS (Music Composer System)*** at £225 includes their professional AL25 interface. The software allows both real– and step–time sequencing.

Step–time entry uses a simple MCL (Music Compostion Language) and notes appear on the screen as they are entered. This is nice and in my opinion it's the best step–time entry systems around with comprehensive editing facilities.

Joreth's software offers a significantly different approach to most other products and has attracted a great many devotees. It's features make it one the most comprehensive C64 MIDI sequencing packages on the market.

The ***Real–Time Part Loader*** (£11.85) allows the loading of real–time files, part by part, from multiple files (you'll realise the usefulness of this if you have the MCS).

The ***Key Programmer*** (£11.85) accepts input in any key (or even no key in particular) and allows key selection before printout.

A quality Casio CZ voice editor which includes features like envelope copy and time–scaling can be found in the ***CZ Tone Editor*** (£44.85). Voices can be stored on disk which saves a fortune on RAM packs.

If the ability to link, loop and repeat up to 128 sections of music with minute precision is important to you, the ***Linker System*** is a suitable extension of the real–time part of the MCS at a cost of £94.90.

System 7 (£79.99) is a voice editor for Yamaha DX7 and TX7 synths which is designed to allow the creation and naming of your own banks of 32 voices. The system has lots of facilities and comes with 320 pre–programmed sounds.

All Joreth's programs can run with other interfaces although their own ***AL25*** is a very impressive device complete wih comprehensive synchronising facilities and is worth considering as your first interface. Because the AL25 plugs into the user port, software from other companies is unlikely to work with it– but the Joreth range is so comprehensive that you may not need any other programs!

Joreth have lots of package deals if

you want to buy more than one of their programs. For example, the Linker and the AL25 Interface is £219.65, System 7 and the AL25 is £199.99 and the CZ Editor is offered at £172.50 with the interface.

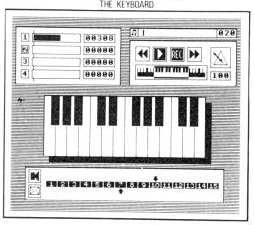
Passport Designs' C64 interface (£110) has MIDI IN, MIDI OUT, drum sync input and output at 24, 48 or 98 ppqn (pulses per quarter note) to suit most drum machines. A version with tape sync is also avaailable at £149.00.

Something of a rarity is Passport's ***Music Shop for MIDI*** (£80.00). Notes are entered in step–time on a stave in traditional notation and the program can produce a printout of your piece at the end. It is very easy to use but much of the MIDI exotica is not supported, a fact which will not worry many users but should be borne in mind. It works superbly with multi–timbral instruments such as Casio's CZ synths. This package forms a very easy introduction to MIDI and represents good value for money.

Eight track sequencing is offered by ***Master Tracks*** (£199) with real– and step–time facilities. Step–time options include full MIDI note and data editing. Notes are described as name plus octave number, eg. C3. Song mode lets you build up a song from pre–recorded sequences and overall it is a very flexible program.

Passport also have voice librarians (*not* voice editors) at £45.00 each for the Yamaha DX7, Roland JX8P, Casio CZ series and Korg's DW synths.

Also available is the MIDI Player (£65.00) which stores up to eight songs or arrangements on a disk and produces a sychronised video display on the screen during playback.



Rainbird Software's *Advanced Music System* (£39.95) is designed to help you get the most out of the SID chip but it also includes a novel MIDI module which acts as a six–track real–time sequencer.

Although not in the same league as the other dedicated sequencers mentioned here, it is certainly interesting. It's ability to convert music files from MIDI and vice–versa is an experience in itself!

Sonus International are well established in America and have recently opened a UK office. They have tons of goodies for the Commodore 64 and look as if they could make a name for themselves by filling the gap left by Steinberg, Dr T et al. Their range of software includes many facilities not available elsewhere for the Commodore so read on!

We'll start with their MIDI interfaces. The standard interface at £54.00 has one MIDI IN and two MIDI OUT's, while for £92.00 you can have one with sync facilities.

To ease newcomers into the world of MIDI, Sonus have an introductory program called ***Glasstracks*** (£54.00) which actually won a software award in the USA. It is basically real–time oriented but with some step–time facilities. It has eight tracks plus comprehensive editing capabilities and the program includes several demo songs and is very easy to use.

The biggie in the Sonus catalogue is the ***Super Sequencer*** (£113.85) and there are separate versions for both the 64 and the 128 to take advantage of all available memory. It can hold 16 sequences over tight tracks and contains a system–exclusive librarian to save, for example, an entire bank of DX7 voices. It has many editing facilities and with the 128 version you can use your keyboard's modulation wheel as a volume control.

Personal Musician 64/128 (£69.00) has file compatibility to the other Sonus systems and is designed for new MIDI users. The package includes all cables and a MIDI interface.

The ***Midi Processor*** (£69.00) can be used to perfect your recordings. With it you can load files from the Super Sequencer and perform elaborate event and range editing on them. Features include the removal of patch changes, pitch and mod wheel, after–touch, sustain–pedal volume and channel information. You can also 'unbounce' – extract information from a channel and put it on another track, clever stuff!

Miditech 64 (£69.00) is a monitor or system–exclusive librarian program. You can view, manipulate and save MIDI bytes as they are transmitted from any MIDI instrument. It includes MIDI filter, trigger functions and a prefix send capability for initiating system exclusive dumps – more hi–tech talk but hackers will find it very interesting indeed.

I haven't seen it yet but ***Scoretrack*** (£155.25) promises to be worth a close look (the final version should be ready by now). One of the main functions available is the ability to printout the scores in traditional notation.

Finally, there is a range of voice editors and librarians. Space is limited so it will have to suffice merely to list them; if you're interested you can get further details from Sonus or you can sample their wares with a Sonus Demo Disk for £6.00 plus £1.50 post and packaging.

DX–TX 7/216/816 Design (£92.00)
DX–TX Digital Disks (£40.25) containing 18 banks of sounds
TX81Z Design (£92.00)
DX21/27/100 Support (£109.25)
RX11/21 Librarian (£34.50)
FB–01 Design (£92.00)
Casio Programmer Librarian (£69.00)
Casio Digital Disks (£34.50) with 10 banks of sounds
Sonic Editor for the Ensoniq Mirage (£69.00)
Sonic Editor for Sequential's Prophet (£69.00)

Summary

A computer can help the less–proficient musician produce technical and complex pieces which would otherwise be beyond his ability (I take advantage of this aspect every time I plug into a MIDI program!). It can serve as a compositional, arrangement or musical teaching aid and, of course, it can be used just for fun. Primarily, I believe music should be enjoyed and the Commodore certainly gives you plenty of options. Whether you're a professional musician or a novice, there's a package somewhere to suit you.

Life in the Fast Lane

Turbo charging your snail paced peripherals opens up a wide and confusing world of cartridges, tapes and chips.

by Norman Doyle

Commodore's tape and disk systems are probably the most reliable available on any microcomputer but they are also the slowest. In my old VIC 20 days this wasn't too much of a problem with only a few kilobytes of memory to fill but even with the C16 loading can take a l–o–n–g time.

The software houses solved this with their own fast load systems which revelled in names like Turbo and Burner but it has been the cartridge revolution which has made these kind of facilities available to the home programmer. Much of this revolution started in Germany and Holland where Commodore owners seem to approach programming their machines with a Teutonic gusto for order and control.

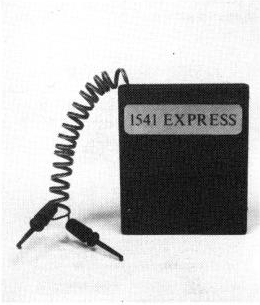
Companies such as Robtek, Evesham Micros, Datel and H&P siezed the opportunity to snap up these foreign products and launched them on the British market. In many cases the popularity of these products was not just because of the fast loaders and savers but the back–up facilities which allowed commercial games to be transferred onto disk or tape.

The first fast disk facility that awakened me to the fact that my 1541 could actually operate faster than normal was ***Disk Express*** and ***Flash!*** which both emanated from **Supersoft**. Disk Express was a plug in device which claimed a modest increase of five times the normal loading speed and could be fitted in seconds. Flash! was a little more sophisticated and required changes in both the C64 and the 1541.

To fit Flash! caused a problem for most C64 owners because the Basic ROM chip had to be removed to make room for the new operating system. The space left by the newly desoldered chip could then be filled with a DIL socket to take the new operating system chip assembly. The problem was that the original ROM chip had to be reinserted into the new assembly, so any careless slips with the soldering iron and heat sink would cripple the computer for several weeks until a replacement ROM could be acquired.

Inside the disk drive the problem was not so dramatic. For many years all the major chip components on the drive boards have all been held in mounts and could be removed by gentle leverage. A connecting lead from the user port on the C64 to the drive then supplied the data line, with a switch to select Flash! or normal operating modes.

A side benefit of the new system was that the new operating system also gave



some extra commands to assist the programmer. Cursor movement was eased with commands to move the cursor to an area of the screen in large jumps. Just as the HOME key moves the cursor to the top left from anywhere on the screen, so the new system allowed a'reverse' homing of the cursor to the bottom right, jumping to the end of lines and erasure of large areas of the screen at will.

Flash! was suitable for a limited and skillful few who could afford the expense of a new system plus the cost of having it inserted if they lacked the ability to do it themselves.

In real terms the speed increase with either of the Supersoft systems was only about twice the normal, nowhere near the claimed five times improvement. This is something worth bearing in mind when reading advertisements, the stated speed benefits always take the optimum conditions into consideration. As a general rule always halve the advertised ratings to get a more realistic figure.

Next in line was a cartridge based utility from **Robtek**. The Robcom series could be used by the novice simply by plugging one of them in. Top of this range was ***Robcom Turbo 50*** which increased disk speeds by five times and held a cassette system which was ten times faster than normal. Additionally the user gained extra, very useful Basic wedge commands which allowed programs to be merged, slow run with a TRACE facility, and listed in a page system one screenful at a time. There was also a simple monitor to assist machine code programmers to develop and check their own programs.

Unfortunately the one, insurmountable drawback of this system was the fact that it downloaded itself from the cartridge and into the computer RAM. This greatly inhibited its use and meant that it could easily be over-written by long Basic programs or by machine code.

This brings us up to the recent past and a new series of cartridges and devices but before we go on to these considerations you may still be wondering how its possible to speed up a tape or disk system.

Routine changes

One myth which should be firmly knocked on the head is that tape turbos actually speed up the recorder. A cassette recorder works at just under two inches per second and there is no practical way that it can be speeded up or slowed down without internal mechanical or electrical changes. The use of tape turbos results in the erosion of the reliability which is built into the standard operating system.

Under normal control each bit of every byte is recorded in a form of electrical'Morse code' signifying the noughts and ones of binary. Added to this is an odd parity bit whose value depends on the preceding eight bits. This is followed by another signal which indicates the end of a'word', the nine bits of data. Then the next byte is recorded.

After each block of 192 bytes the computer leaves a two second gap, once again adding to the length of the record. Before moving on to the next block, the system re-records the previous block to insure against tape dropouts corrupting the data. This means that each program is effectively recorded twice to ensure reliability.

Simply by stripping away the structure of the tape system over 50% of the normal loading and saving time can be achieved. For many loaders this is increased to a greater degree by cutting the lengths of the pulses which form the'Morse code' used to record the data. This increases the concentration of data per inch an tape but does make it more vulnerable to failure.

The tape speeds achieved with a well-designed turbo now equals that achievable with a disk drive load. Accordingly, the tape recorder must be in tip-top condition. The record/playback head must be accurately aligned and the use of an azimuth alignment tape is essential. The Robcom Turbo 50 has a built-in alignment program and separate tape for this purpose. I know of no other system which applies such foresight and for most people their only resort is to invest more money on one of the commercially available alignment systems such as that produced by **Audiogenic** or ***Azimate 3000*** from **Evesham Micros**.

Disk turbos can work in one of two ways. Either the baud rate (the speed at which it communicates with the computer) is changed or the way that the program is physically stored on the disk is changed.

The most radical disk turbo system that I saw was ***Turbo 64*** from **Cockroach Software** of Australia. This took over the normal disk storage system and formatted the disk to suit its own requirements. Unfortunately this does not help when a commercial disk is acquired and it has no turbo of its own. It's far better to get a system which accepts the disk storage system on the 1541 but ups the baud rate.

Today's Turbos

Much of the attention these days is turned towards disk turbo systems which, at best, can achieve speed increases of up to 25 times the normal rate.

Most turbo systems are only available on cartridge. Unlike the Robtek cartridge, this new generation is virtually invisible to the system. Rather like an electronic iceberg, the tip of the system only protrudes into a few bytes of the C64s internal memory. The main part of the program resides externally within the cartridge, totally undetectable.

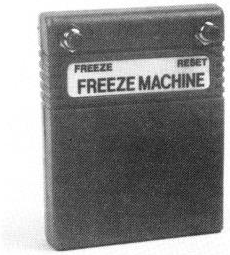
If its a no-nonsense turbo-disk operating system that you want then it's still possible to buy Quickdisk+ from Evesham Micros. The Quickdisk+ system offers a basic operating system, giving five to seven times a speed increase, whose commands are similar to the DOS wedge supplied on the demonstration disk which comes with the 1541.

This system eliminates the necessity to type in OPEN commands to read error channels or issue disk commands,

replacing this complex and time consuming syntax with a single keypress. It also has a facility for listing the directory onto the screen, a simple Centronics printer driver and a help menu for only £19.95.

Datel have a cartridge to compete with the speed of Quickdisk+. Called ***Diskmate II***, it not only has a more attractive price at just £14.99, but also has a wider range of functions including extended Basic commands and a monitor.

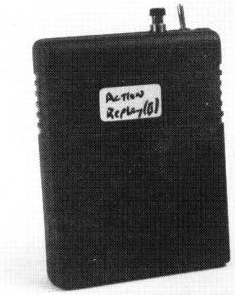
It's Evesham who supply the excellent ***Freeze Machine*** which absolutely bristles with facilities apart from its disk and tape turbos. The speeds of the turbos are further enhanced by the inclusion of a program compactor on the cartridge. This reduces the program to the minimum possible number of bytes and then re-expands the program after loading.



The Freeze Machine contains *two* fast disk routines. The first is equivalent to the Quickdisc+ system giving about five times normal speed but the second, Lazer II, system claims an amazing 20 times faster than normal.

The only drawback with the Lazer II routine is that it saves the program file as a USR file on disk. This means that transfer and erasure of the program is impossible. If you want to remove a program from a Lazer II disk, then you have to load and resave the programs that you want to keep onto another disk and then reformat the old disk.

Despite this, Lazer II and the Freeze Machine form the fastest combination in any cartridge system. Evesham Micros claim that you could load your favourite game in as little as ten seconds and no more than 18! Considering that the Freeze Machine only costs £28.95.



Action Replay MkIII's companion program, ***Warp 25***, claims to be the fastest fast loader available. Unfortunately I wasn't able to test this claim but I doubt if the difference is particularly significant over Lazer II. What *is* important is that it can be obtained on disk from **Datel** for just £2.50!

At £30 and with a disk speed only six times normal, the ***Final Cartridge*** from **H&P Computers** may seem to be a little outmoded now but it has many other things to offer in addition to its disk speed. If your needs are for a faster disk system but backed up by plenty of Basic facilities and a machine code monitor, then this could be well worth the money.

My favourite system is the **Trilogic *Expert*** cartridge. Unlike the other

cartridges, this is a RAM chip which can have the current Trilogic software booted up onto it. The disadvantage of this system is that any spike through the mains supply will upset it and require the system to be rebooted. This is a small price to pay, I feel, for a system which can be kept at the forefront of the backup and disk speed revolution at low cost.

The other nice thing with the Expert is the way that the monitor drops in with a readout of the memory location at which it was interrupted, a fantastic debugging facility.

I think I'm digressing a little! The main point about the Expert is that it incorporates an excellent compaction system which is the envy of many a software house. This, and the turbo loader, means that no program takes longer than 30 seconds to load and the cartridge is competitively priced at £29.99.

Deciding on a cartridge system is not merely a case of weighing up the pros and cons of the disk and tape turbos. They are package deals and just as I prefer the Expert, another programmer may prefer Action Replay, Final or Freeze Frame. The only way to decide is to read the ads, decide how much you believe and sift through the range of facilities to see how many you need and how many would not be used.

Flash Successors

The Flash! system needed a chip change in the C64 and this seems to be the trend once more. All three of the big utility suppliers have a chip change system: **Datel**'s ***Professional DOS***, **Trilogic**'s ***Phantom*** and **Evesham Micros'** ***Dolphin DOS***.

Much higher speeds can be achieved if the data is sent in parallel through the computer's user port. This means that information can be exchanged between disk and computer a byte at a time instead of a bit at a time in serial interactions. Obviously this is about eight times faster but it does mean a new operating system has to be installed.

One fact that all the systems seem to gloss over is that fitting these systems isn't child's play. I've seen inside many a C64 and in all but one case the ROM chips

were soldered directly onto the PCB. This means a desoldering job for most people.

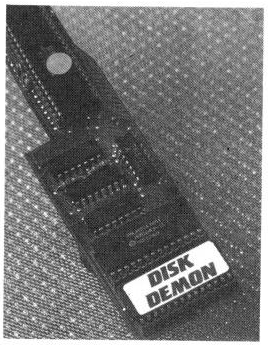
Don't attempt this job yourself unless you know what your doing. The complexity and vulnerability of both the chip and the PCB trace is a formula for total disaster. If a good heat sink isn't used the chip will be irrepairably damaged and, if all of the solder isn't removed, you could strip the pathways off the surface of the board and then you've got serious problems.

Given these two situations its better to risk overheating the chip to ensure that the PCB is undamaged. I say this for two reasons; firstly because a replacement chip can be acquired more readily and, secondly, because you may never need the chip anymore!

Using a solder sucker and a substantial heat sink I've removed many a ROM without causing damage. I've had more problems soldering in the replacement IC socket which seem more ready to shed a leg than a dragonfly in the mating season. The lesson I've learnt is not to settle for a cheap, fragile and, therefore, shoddy socket.

Once you've spent an hour or so modifying the board, it's just as the ads tell you'fitting only takes a few minutes and usually requires no soldering'! Pah!

Professional DOS includes an operating system called Disk Demon. It boasts an unbelievably fast rate of 60 times faster than normal load. This means that a 202 block file loads in under 3 minutes, a transfer rate of over 15,000 bytes per minute or 135,000 baud! A rate this high is, frankly, suspect. Datel could not supply me with a copy of Professional DOS by the time that this magazine went to press but I wait to be convinced of the reliability of this data transfer rate.



The rest of the system's claims seem to be much more moderate with program and sequential file save times 20 times the normal rate and a sequential file load 25 times faster than normal.

The system also adds thirty new commands to Basic and includes a fast file copier. The Professional DOS costs £64.99 on the C64 or £69.99 for the C128/64 version.

Trilogic's DOS claims a 240 block load in 7 seconds which, at just under 70,000 baud is a more plausible rate than Datel's claim.

Trilogic boast that full error checking has been retained which'other systems' have sacrificed in favour of speed. An additional 60 commands include those which allow the system to ignore write protect tabs. To the user this means that disks can be doubled simply by flipping them over, no more hole punching.

At £78.99, Phantom is not a cheap system and their is no C128 mode version but it is 100| British, by Jove.

Dolphin DOS isn't British but it's probably the model for the new generation of turbo DOS chips. Having been around longer, this system is one that I'm very familiar with and one slightly worrying factor is possibly a cause for concern with the Datel and Trilogic systems as well.

Dolphin DOS seems to make the 6522 output chip more vulnerable than before and the recommended switch on procedure of C64 on and then 1541 *must* be adhered to every time the system is powered up. Through casual careless moments, I have succeeded in burning out this chip twice during the year that I've had the system running and it does add quite a lot to the cost of the system!

Care is rewarded with a system which will load 202 blocks in less than 5 seconds (85,000 baud), a save speed which is 12 times the normal rate for program and eight times for sequential files. Like the old Flash! system there is also a full screen editor system.

The inclusive monitor is a very basic but useful utility and the single keypress command channel access is carried over when in Basic programming mode. Apart from this only three extra Basic commands are added with Dolphin but you do get a free Dolphin Copy disk.

At £69.95 it falls midway between the other two systems but does have a long and reliable track record to support its claim to be the'established standard' turbo for the C128/64 with 1541 drive.

Turbos have now gone as far as they can go. Any further increase in speed will definitely be at the expense of reliability and chip safety. The C64 can only cope with so much and who really needs a full memory load faster than 3 seconds?

Touchline

Datel Electronics
Units 8/9
Dewsbury Road
Fenton Industrial Estate
Fenton
Stoke–on–Trent
Tel:0782 273815

Evesham Micros
63 Bridge Street
Evesham
Worcs
WR11 4SF
Tel:0386 41989

H&P Computers UK
9 Hornbeam Walk
Witham
Essex
CM8 2SZ
Tel:0376 511471

Supersoft
Winchester House
Canning Road
Wealdstone
Harrow
Middlesex
HA3 7SJ
Tel:01–861 1166

Trilogic
Dept PX 3
329 Tong Street
Bradford
BD4 9QY
Tel:0274 691115

On-Line Line Up

Computer communications are a source of confusion to many people. We supply the key to modem living.

by David Janda

Going online with your Commodore may seem like a daunting task at first, but there's a fascinating world of computer communications waiting which can be accessed with very little effort.

Purchasing the software to get going is no problem. Basically there are two types of package: viewdata and terminal. Viewdata software enables you to access services such as Micronet and Prestel which feature low resolution, colour graphics. Terminal software on the other hand simply offers plain text, but is still by far the most popular user interface in the world of comms.

Your next item will be an RS232 interface to plug into the user port of the C64. There is a large number of interfaces available, and you can pick one up for as little as £20.

Undoubtedly the most difficult choice to make is which modem you should buy. This depends entirely on what you want to do. If, for example, you wish to subscribe to Micronet 800 then all you'll need is a modem that can operate at 1200/75 – they'll even give you one free if you subscribe for a year. However, if you wish to access bulletin boards and online databases such as Telecom Gold then the sky's you limit.

Various modems operate at various speeds. Generally speaking, the faster the operating speed of the modem the faster you can send or receive information. It's also true that the faster the modem, the more expensive it is.

Of the modems that are currently on the market today, ther are three basic types:

Manual: these are quite simple and have to be operated manually by pressing buttons. They are also the cheapest.
Software controlled: modems such as the Designer are software controlled and, as the name suggests, they need the appropriate software to allow full access to the modems features.
Intelligent: this type of modem is still quite rare in the home or small business markets as they are very expensive indeed. Intelligent modems have their own set of commands and can be used fully automatically.

We can now go on to look at a selection of modems that cover all three types.

VOYAGER 7

The Voyager 7 is a V21/V23 device which is suitable for use with Viewdata and scrolling types of databases (DB). The baud rates available are 300/300, 1200/75, 75/1200, and 1200/1200 half duplex. A test mode allows the modem to be tested offline at 300 baud.

The Voyager 7 offers auto-dial and auto-answer as standard, but it should be pointed out that the Voyager is not approved for auto-dialling and that the auto-answer option has been found to be very unreliable. Potential buyers are warned to test these facilities before making a purchase.

The modem is of 'average' size; 165x145x55mm. Four rubber feet keep it from sliding around and an ample length of mains and PTSN cable are provided. A five-pin Domino type (female) socket at the back is used to connect the Voyager to the Comms Cartridge or RS232 interface, and a six-way rotary switch on the front panel is used for selecting the baud rate (originate or answer) or the test mode.

Five coloured LEDs on the front indicate data flow, power, carrier detect and so on. There is a lack of an on/off switch or an inline telephone socket. The latter means that it will be necessary to purchase a splitter socket in order to use your phone on the same socket if you want to avoid a lot of plug swapping.

The Voyager is a software controlled modem and is therefore best used with auto-dial and auto-answer software such as Mustang but the main problem with this modem is its reliability. As mentioned, the auto-dial feature is not approved but many people don't take any notice of this. However, the auto-answer facility cannot be guaranteed as Modem House, the now defunct company who

produced the Voyager series, had problems with production. As a result Voyagers with a serial number less than 1200 will not auto-answer. However, in tests, Your Commodore has found that some Voyagers with serial numbers higher than this have not auto-answered either.

Other aspects of the modem were fine and, taking the faults into consideration, it does the job satisfactorily. If you can pick up the Voyager 7 for around £40 then you have a bargain, if the price is higher then look elsewhere.

NIGHTINGALE

The Pace Nightingale was one of the first reliable duel speed modems on the market. It has been available for a number of years and is now sold as the official Amstrad modem.

The modem operates at 300/300 baud (originate and answer), 1200/75,75/1200 and 1200/1200 half duplex. The early (non-approved) versions also operated at 300/300 full duplex at Bell frequencies, which means that it could unofficially be used to connect to American systems. The modem also features a 300/300 baud self-test mode.

Three push buttons are situated on the front panel of the Nightingale. One is marked modem select and is used to seize the line once a carrier is detected. The second and third buttons select the speed and whether to use originate or answer mode.

On the older, non-approved models an extra button was used to switch between US Bell or European frequencies. This button was removed and covered with a plug to gain BABT approval. The reason why US Bell frequencies are not approved is because they cause havoc with BT test equipment!

Despite the BABT approval, it is possible to remove the plug and insert a push button to restore US Bell capability but this would invalidate warranty and upset BT.

Two tri-colour LEDs on the front panel indicate carrier detect/line hold and power/data. At the rear of the modem is a recessed BT socket that the phone plugs into, a push button for selecting self-test and a five-pin RS423 Domino socket (female).

One other item of note is that there are plenty of ventilation grills on top, and underneath the modem. Handy, as there is no on/off switch and its easy to leave the modem plugged in.

The Nightingale is a manually operated modem, and as such the auto-dial and answer facilities of any software used with it will not be of any use. Having said that, it is perfectly possible to use the Nightingale with packages such as Mustang; simply press the modem connect button when the carrier is heard and press the RETURN key on the computer.

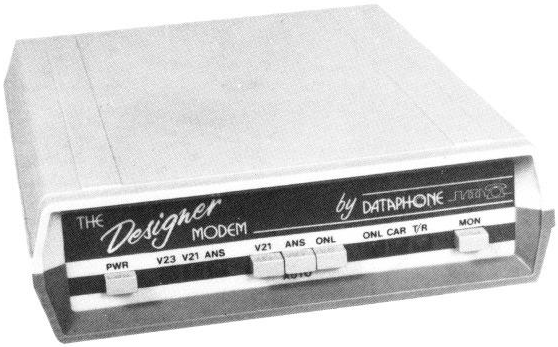
An interesting non-documented feature of the Nightingale is that it will auto-answer when in reverse Prestel mode ie. 75/1200. This is achieved by setting the speed to 75/1200 and pushing in the carrier detect button. After a few rings the modem will answer! It should be noted that this'facility' was not purposely designed.

Although the Nightingale is technologically rather old hat, it has the advantage of being a very, very reliable modem, and, although rather expensive when compared to low cost modems with more facilities, it can represent excellent value for money when purchased secondhand.

COMMODORE MODEM (C64)

The Commodore Modem is also referred to as the'Compunet modem' because it was designed to be used with that service.

Unfortunately Commodore don't manufacture the modem any more, which is a shame as it is a very versatile device even though the specification apparently belies this fact.



The Commodore Modem operates at two speeds only: 1200/75 and 1200/1200 half duplex. However, the 1200 half duplex mode, as with the Designer modem, has a very fast turnaround time, and as such can be used with all the enhanced software that Y2 Computing produce.

The plus side to the Commodore modem is that it contains terminal software on ROM specifically designed for connection to Compunet. This firmware includes a HELP facility, a frame editor and the ability to load and save software patches that enhance the C64 when online (see the section on Compunet).

Connecting to Compunet is done by entering'C' with the shift key held down and then pressing RETURN. You will then be prompted to enter a phone number which the modem will auto-dial for you.

The modem is completely software driven and plugs into the C64's cartridge port. A telephone lead trails from the back of the modem but an inline socket would have been more useful.

Because the modem is no longer in production, and is designed for use with the Compunet service does not limit it in any way. User to user software can be obtained from Compunet or Y2 Computing and one very popular package is Dialtext which is available from Micronet 800. Also available from Micronet on disk or tape is the Mustang software which gives the user access to Micronet through this *Compunet* modem! All things considered, the Commodore Modem is a very useful item that is ideal for viewdata, Compunet and scrolling terminal applications (at 1200/75 baud of course), and is ideal for user-to-user purposes provided you have the right software. Although no longer in production, these modems can be picked up secondhand for as little as £25.

DESIGNER

For those who are not satisfied with the existing range of software-controlled modems, and yet do not want to spend a large sum of money on an intelligent model, the Designer modem from Dataphone could be just what you're looking for.

Dataphone have answered the prayers of many by combining elements of a manual modem with those of a software-controlled modem, added extra features and packaged it into a neat unit.

The Designer can operate at 1200/75 originate, 75/1200 answer, 300/300 originate and answer and 1200/1200 baud half duplex. It's worth noting that the 1200 half duplex mode has a very fast turnaround time (unlike the Voyager, Enterprise or Nightingale), which means the user-to-user and file transfer software supplied by Y2 Computing will be compatible with it.

The modem itself is very well designed and has a low profile. The software-controlled aspect enables the modem to be used for auto-dialling/answering. The Mustang software will do this well.

Another software controlled feature is the auto-baud rate scanning, but at the time of writing there was no Commodore related software to make use of this feature. However, Dataphone are currently working in conjunction with a comms software house to rectify this situation.

The Designer can be completely controlled manually by using the five push button switches on the front panel. Three switches are used to select the speed and to put the modem into originate or answer mode; two more switches introduce features not found on a modem of this price.

Firstly, there is a power on/off switch and, secondly, there is a monitor on/off switch. The monitor allows you to hear the call in progress and is very handy for detecting a bad line. Six LEDs on the front panel also give you a full status readout of the modem.

One feature that is not visable, but welcome, is the anti-tinkle circutry that suppresses the annoying tinkle that modems like the Voyager and Enterprise make when auto-dialling.

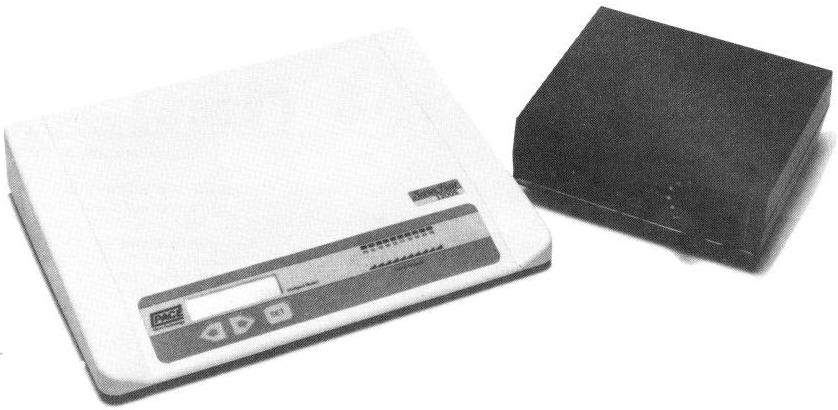
On the back of the Designer is a 25-way, D-type RS232 connector (female) and a recessed telephone socket. A generous length of telephone cable trails from the rear as does the power cord which is fitted with a plug.

In use the Designer performed perfectly. The option of controlling it by software or manually is very handy and makes the Designer an extremely flexible tool. But by far its biggest asset is the price. For £99.95 excluding VAT, it represents excellent value for money.

ENTERPRISE 1

The best way to describe the Enterprise 1 is to say that it's a Voyager 7 with bits added on. Their appearance and control are almost identical; this is not so surprising as both the Enterprise 1 and the Voyager 7 were manufactured by Kirk Automation.

The Enterprise 1 is housed in a black casing with green lettering on the front



panel. A rotary switch on the right is used to select the required baud rate which can be one of 300/300 originate/answer, 1200/1200 half duplex, 1200/75, 75/1200 baud and test. A feature not found on the Voyager 7 is the on/off–line button which is used when dialling/answering manually. An oddity is that when the button is pushed in the modem is offline and when the button is out it is online – the reverse would have seemed a more logical choice.

Situated at the rear of the modem is the RS232 socket (female), phone socket, telephone lead and power cable. Of particular interest is the 21–pin RS232 connector which uses pins 1–6, 15, 17, 20, 22–23 and 25. Basically this means that connecting the Enterprise to your Commodore should be no problem as a variety of wiring options is available.

The phone socket is recessed in accordance with BT regulations, and this enables a telephone to be used in line with the modem thus saving you the expense of purchasing a double adaptor.

Using the Enterprise 1 is simplicity itself – even though the manual is not up to standards. When used with software such as Mustang from Y2 Computing, the auto–dial feature can be used. The Enterprise series uses relay technology to auto–dial which is quite loud in operation and not the most reliable method of getting a telephone to dial. One effect is that auto–dialling will cause any phone extensions to'tinkle' which can be annoying. This is a common trait of all software controlled modems.

One aspect of the Enterprise 1's operation that is annoying is the auto–answer facility which is controlled by the terminal software. Auto–answer would only work providing that a three wire extension is being used. Potential purchasers are advised to test this facility before buying.

Despite this, all other aspects of the modem's operation were fine, and I would conclude that if you are looking for a cheap (but mostly reliable) modem with dual speed operation then it would be a good idea to shop around for an Enterprise 1.

SERIES FOUR

The Series Four range of modems from Pace Micro Technology consists of three models, and the item reviewed was the 1200S which is in the middle of the range.

What you get for the price is sophistication with simplicity. The Series Four is one of the new breed of'intelligent' modems. That is, a lot of the work that is normally done by the RS232 interface software is done by the modem itself which has its own control program and central processing unit and is, in effect, a computer in its own right.

Control of the modem is achieved by sending commands from through the terminal software. These commands were developed by the Hayes Company and are widely used throughout the industry.

The 1200S review model can operate at 300/300, 1200/75, 75/1200 or 1200/1200 full duplex. It features auto–dial, auto–answer, auto–baud rate detection and selection. Also included is a battery backed calendar clock and notepad which has the facility to store up to 64 phone numbers in its internal memory. The 1200S also features a full RS232 port with inline phone socket as well as a Centronics printer port and 20 segment LED display with line strength indicator. Speed buffering is also incorporated enabling the modem to connect to a host at one speed whilst the terminal software is operating at another.

The modem itself is quite flat but takes up a lot of space. The front panel consists of an LCD display with two touch–sensitive buttons (that are used to manually select options) plus the line status and line strength LEDs. At the rear of the modem is the socket for the external power supply unit, the inline phone socket, the Centronics port and a reset switch.

Once connected to the micro, the 1200S is easy to operate. Due to the way the modem is wired up to the micro the comms software will think that the modem is online and can go into terminal mode. The reason for this is that the commands to operate the modem are entered from the keyboard whilst in terminal mode. To understand this better consider the following example.

You would like to contact Telecom Gold at 1200 baud full duplex even though your software does not have a 1200 full or half duplex mode.

First of all a speed must be selected from the software menu. Although you want 1200 baud eventually the choice is purely arbitrary such as 300/300 baud just so that you can go online. Even though you aren't connected to a host at this point, the modem'tricks' the software into thinking that it is.

At this stage you are greeted with a blank screen but by entering'AT?', the Series Four HELP screen is displayed (Table 2). To connect with Telecom Gold at 1200 full duplex you would simply enter the following:

ATD 583 1200

The rest now happens automatically with the modem dialling, detecting the carrier, selecting the appropriate baud rate and so on. Even though the terminal software still only operates at 300/300 baud it's possible to use services that operate at 1200 baud full-duplex because of the Series Four's internal memory buffer keeping things in check. The net result of this is that the modem is exceptionally easy to use, but extremely powerful at the same time.

TABLE 1 – Series Four AT Command Set

A Answer call without delay
C Carrier control (C0/OFF, C1/ON)
D Dial number and originate call
E Echo commands (E0/OFF, E1/ON)
F Echo data (F0/ON, F1/OFF)
H Hook control (H0/ON, H1/OFF)
I*n* isplay Identity (n/0,1,2)
K*n*£ Display/set time/date (n/0,1,2)
L*n* Speaker Loudness (n/1,2,3)
M*n* Monitor status (n/0,1,2)
N£ Display/set number store
O Go back on-line
P Pulse dialling ON
Q Result code (Q0/ON,Q1/OFF)
R Reverse to answer after dialling
S£ Display/set S registers
T Tone dialling ON
U£ Unattended mode (U0/OFF, U1/ON)
V Result code (V0/Numeric,V1/alphabetic)
W Wait for secondary dial tone
X*n* Extended result code (n/0,1,2,3,4)
Z Resets S registers/commands
NOTE:'£' indicates additions to the standard Hayes command set.

MULTIMODEM (C64)

The Multimodem from Miracle Technology is a combination of hardware and software in one package. If you are looking for a modem that can be used for viewdata as well as terminal applications then this could be what you're looking for.

The modem operates at 1200/75, 75/1200, 300/300 answer and originate, and at 1200 half duplex. A 300/300 baud full duplex mode is also available for Bell tones. Other hardware features include auto-dial and answer (which are controlled by the software) and a very fast turnaround time when using the modem at 1200 half duplex

Y2 Computing have written a number of programs including user-to-user and enhanced 40 column packages. These require modems that have a very fast turnaround time and the Multimodem could fit the bill.

The Multimodem lacks buttons and switches because it's completely software driven. It plugs into the C64 cartridge port and has a telephone cable trailing from it which plugs into a standard telephone socket. No telephone socket is supplied on the modem itself, so it will be necessary to purchase a splitter if you wish to use a telephone on the same line.

Using the Multimodem via its menu-driven software is very simple and the combination is a nice one, leaving you the option of buying other packages such as Y2's file transfer package.

PRISM 2000

If you subscribe to Micronet for one year, and pay in advance, they will give you the Mustang viewdata and terminal software on disk or tape and a Prism 2000 modem free of charge!

The modem is no longer being manufactured, but was one of the first to be approved for use at 1200/75 baud. Two speeds are available, 1200/75 (for use with Prestel/Micronet) and 1200/1200 half duplex. The half duplex mode is a little awkward to use, requiring you to manually switch from send to receive by pressing a button. The modem can otherwise be turned around by software control and details are given in the manual.

The Prism 2000 is good for accessing the viewdata services for which it was designed.

Fresh Chips

With the Printer IV chip you can improve the quality of the copy you get from your MPS 801 printer.

By Paul Eves

One of the biggest drawbacks of the MPS 801 printer is the lack of true descenders. There have been many programs written to overcome this problem. There have also been many top quality programs written which provide the user with the option of many different font styles. (*Font Master* is just one which springs to mind). All these programs have one thing in common. As software, the user has first to go through the process of loading in the program, then selecting a given font from a menu before getting on with the job in hand.

Printer IV on the other hand has none of these drawbacks, as hardware, once the chip has been installed you just flip a switch and turn it on. The selected font is now ready to go.

Fitting the chip is simplicity itself. It only took me three minutes and I am hopeless with electronics. Instructions for fitting *Printer IV* are as follows:

1. Disconnect the printer from the mains, remove the perspex cover, paper shelf, and feed knob.
2. Using a cross-head screwdriver, remove the four screws holding the upper housing and the lower housing together. Lift the top away to expose the tray holding the electronics. Lift and remove the tray to the rear of the printer. Using a flathead screwdriver, carefully lift out the original character ROM chip (this is a 24 pin chip).

N.B. Take careful note of the position of the chip e.g. a small notch at one end.

3. Take the *Printer IV* character chip together with adaptor, and fit this into the carrier that housed the original chip (taking note of the position of the notch in the chip which should in most cases be facing the right of the printer looking from the front). The fly lead with the two logic switches can be placed to suit (I have drilled a small hole in the rear of the housing, threaded it through and it is now permanently secure).
4. Re-assemble the printer and you are ready to use your new character sets. CAUTION: Opening the printer will invalidate your warranty if it is still in force at the time.

There are four character sets available to you:

1. Descenders
2. Scribe
3. Eclipse
4. Futuristic

When using a word processor, it is advisable to use a pause command before switching between character sets.

It is inadvisable to switch between sets while the printer is actually printing. This will cause corrupted characters and will also result in a blown fuse inside the printer.

I would also advise that you put the original ROM chip safely away somewhere.

For anyone who uses their printer often this chip is a must. It's quick and easy to use and the end results are impressive.

PRINTER IV ROM CHIP

```
10 ******************************
12 *  EXAMPLE OF NORMAL TYPE    *
14 ******************************
16 :
18 :
20 POKE53280,11:POKE53281,11
22 PRINT"[CLS][YEL]ROM CHIP IV"
24 FORA=49152TO49167:READK
26 POKEA,K:CK=CK+K:NEXT
28 IFCK<>1579THENPRINT"NO":END
30 SYS49152
32 DATA0,45,134,145,125,153,134
34 DATA32,87,198,42,225,215,1,23
36 :
38 :
39 :
40 :

10 ******************************
12 *  EXAMPLE OF ECLIPSE TYPE   *
14 ******************************
16 :
18 :
20 POKE53280,11:POKE53281,11
22 PRINT"[CLS][YEL]ROM CHIP IV"
24 FORA=49152TO49167:READK
26 POKEA,K:CK=CK+K:NEXT
28 IFCK<>1579THENPRINT"NO":END
30 SYS49152
32 DATA20,45,134,145,125,153,134
34 DATA32,87,198,42,225,215,1,23
36 :
38 :
39 :
40 :

10 ******************************
12 *  EXAMPLE OF ITALIC TYPE    *
14 ******************************
16 :
18 :
20 POKE53280,11:POKE53281,11
22 PRINT"[CLS][YEL]ROM CHIP IV"
24 FORA=49152TO49167:READK
26 POKEA,K:CK=CK+K:NEXT
28 IFCK<>1579THENPRINT"NO":END
30 SYS49152
32 DATA20,45,134,145,125,153,134
34 DATA32,87,198,42,225,215,1,23
36 :
38 :
39 :
40 :

10 ******************************
12 *EXAMPLE OF FUTURISTIC TYPE*
14 ******************************
16 :
18 :
20 POKE53280,11:POKE53281,11
22 PRINT"[CLS][YEL]ROM CHIP IV"
24 FORA=49152TO49167:READK
26 POKEA,K:CK=CK+K:NEXT
28 IFCK<>1579THENPRINT"NO":END
30 SYS49152
32 DATA20,45,134,145,125,153,134
34 DATA32,87,198,42,225,215,1,23
36 :
38 :
39 :
40 :
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Net Benefits

What are networks and bulletin boards all about? We leave no stone unturned as we engage in communications.

by David Janda

When you get your first modem you meet your first problem: who can you call? The three main networks, Micronet, Compunet and Microlink, require a subscription payment if you want to get more than just a few free screens. Is it worth the money or is it best to stick to the bulletin board circuit?

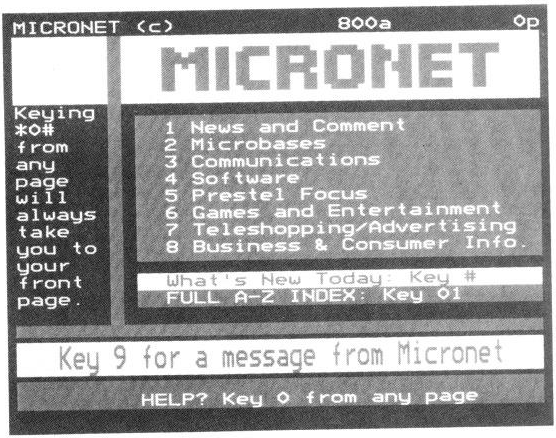
MICRONET

Micronet 800 started approximately three years ago. The service is an information provider (IP) operated on the Prestel database. Subscribing to Micronet not only provides the user with access to Micronet itself, but also access to the rest of the Prestel database. Furthermore, you can register as an Interlink user for free which provides a gateway to Telecom Gold and all of its services.

The structure of Micronet is fairly simple. Pages of information (called frames) measuring 40 characters by 24 lines are displayed on the TV or monitor. Each frame can incorporate colour and low resolution graphics.

All frames are numbered and priced. The majority of frames on Micronet are free to subscribers, but some services do incur a charge which is displayed at the top right-hand corner of the frame.

Manipulating Micronet (and the rest of Prestel) can be done in one of three ways. First, providing you know the specific page number you want to look at, you can enter an asterisk followed by the page number and this will take you directly to that page. Secondly, keyword searching enables you to enter a name associated with a particular page. For example, to get to the 'front page' of the Shades adventure game simply enter £SHADES. This is, by far, the best way to move about Micronet. Thirdly, pages will often have messages along the lines of 'Press 1 for news'. Pressing one will get you to the news pages. This option is especially useful to those new to the service.



Micronet mainly caters for the BBC micro, Commodore 64 and ZX Spectrum, each of which has a *microbase* dedicated to it. These microbases can be considered as mini-databases within Micronet. A microbase has its own features and reviews which are supplied by the editorial staff. Each area also has a user group section with articles and features supplied by editorial staff and subscribers alike.

Some of the features found on Micronet include the news pages, Micro

Mouse, Bizznet, Sunday Xtra and Chatline. The news is updated daily with the latest microcomputer news. Comms fans can tune into Micro Mouse which is a daily column edited by Steve Gold who gained notoriety for the Duke of Edinburgh hack a few years back.

Bizznet is an area on Micronet which is not micro related but is aimed at the small business user, providing features on subjects such as tax and insurance.

Another non-micro related area is Sunday Xtra which has film and record reviews plus a gossip column all presented in a magazine format.

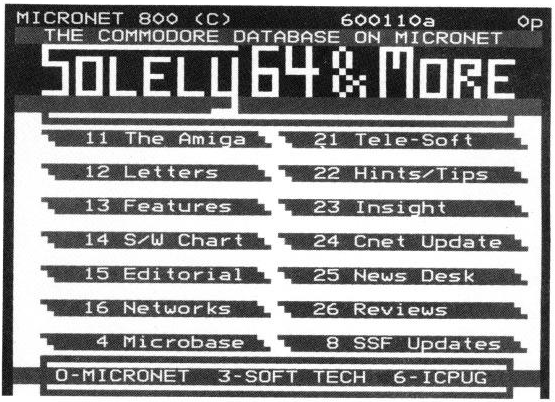
A Mainframe Chatline service allows subscribers to'talk' to each other on a public type of bulletin board. Messages are updated instantly, numerous Chatlines are provided, each dedicated to a specific area of interest. A Celebrity chatline is held each week where a special guest answers questions put by subscribers. Subscribers can also book frames in a special gallery area and use them to start their own mini-magazines.

A major part of Micronet is the Telesoftware area. This stores software that can be downloaded into the micro and saved to disk or tape. Commercial, subscriber and free software is provided but, where there is a charge, the user is always informed of the price before downloading.

COMPUNET

Compunet has been in service for the past three years and was designed to'interface' with the C64 micro. Until now the service was exclusively for Commodore 64 owners but there are future plans to cater for other types of micro, the first being the Amiga. Because Compunet is geared towards the C64 user, the database is much more flexible and can take full advantage of the Commodore machine. This is the biggest advantage of a dedicated system.

The database is organised as a series of directories arranged with a tree-like structure. Each directory can contain one or more entry which may be text, a program or a further, more detailed directory. Each directory follows a common format. This includes the indexing which informs the subscriber



which part of the database they are currently accessing. This index consists of a name and a directory reference number.

Entries also contain a standard set of information. This includes the page number, name, type of entry (program text etc), price (if any), life on system in days, author and a vote.

Traversing the database and issuing commands are very easy. The bottom line of the display forms what is called a duckshoot menu. This can be scrolled from left to right until a command is centred. Through these commands the subscriber is able to upload, download, show the contents of a directory entry, access electronic mail and so on.

To call up a directory entry it is first necessary to move a blue bar over the entry using the cursor keys. If it is a text entry, the SHOW command on the duckshoot will cause the contents of the entry to be displayed in C64 text mode. If, on the other hand it is a program it can be downloaded straight onto disk.

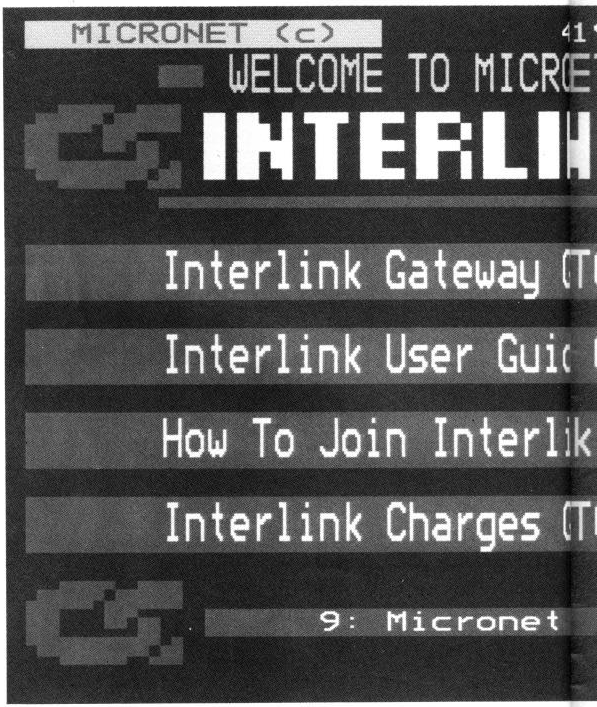
Moving about Compunet can be done in three ways. First, by going directly to an entry with the GOTO command followed by a page number or name. Secondly, by using the DIR command to go further down the tree, or by using the BACK command to go higher up. Thirdly, frequently used areas can be accessed by pressing one of the C64 function keys.

The contents of Compunet are mainly supplied by the users themselves. Compunet design the structure of the database and provide many services such as the Courier electronic mail service, guidelines, Multi-User Games (MUGs) and so on.

Many of the top Commodore software producers sell their software via Compunet at reduced prices. A service called party-line enables real-time chatting between individuals or groups. Another very popular area is the adventure game areas which feature MUD and FEDERATION.

By far the biggest attraction on Compunet is an area of the database called The Jungle. This area can be used by the subscriber as a marketplace into which they can upload and distribute their own programs or text! Other users may then access or buy this material ensuring that this electronic bazaar contains a wealth of useful programming information, club news, free software and so on.

Another very powerful aspect of Compunet is that facilities can easily be added, any changes to the system that would normally require modification of the user's communication software is not necessary as a software'patch' can be downloaded into the C64 (or other micro) before logging on.



MICROLINK/TELECOM GOLD

For the past four years British Telecom has operated an electronic mail service called Telecom Gold. It's a service aimed officially at the business user but in reality it's far more then that.

BT Gold can be accessed by any micro, modem and terminal software combination with a scroll facility. Further, it can be accessed at a variety of speeds from 300/300 full duplex to 1200/1200 full duplex. It can also be accessed from PSS which is BT's high speed data network.

At first sight BT Gold seems dauntingand yet it's really quite simple to use. Unlike Micronet/Prestel and Compunet, BT Gold is operated by issuing a number of commands.

The facilities provided by BT Gold are tailored for the business user. Each subscriber has a mailbox and can send and receive electronic mail to and from other subscribers be they in the UK, or anywhere in the world with a Dialcom system in operation. Telex facilities are also provided as well as a number of games, and business programs such as spelling checkers, statistical tools, and forecasters.

Help is always at hand with the HELP and INFO commands. Even from within a program (such as the text editor) help can be sought by entering'?'.

BT Gold is split into a number of systems but subscribers can still communicate with each other regardless of the system they are using. One such system (72) is called Microlink and is operated by Database Publications.

A subscriber to Microlink has all the facilities of a Gold user and plenty more. Microlink has a menu driven front end to BT Gold which is very user friendly. Microlink also provides a number of enhanced services such as a bulletin board, telemessage service, regular micro news, telesoftware (not for Commodore micros though), and gateways into other computer databases.

One such gateway is to the Mnematics service in the USA. Mnematics is a database which offers multi-user games, software (for the Commodore!), special interest groups, real-time chat and so on. It's rather expensive to use at 25p a minute, but far cheaper then dialling the States direct.

Subscribing to Microlink is by far the best way to gain access to BT Gold. This is due to a number of reasons. Firstly, there are the added facilities that Microlink provide. Secondly, Microlink has a monthly subscription fee of £3 which is quite cheap considering that normal BT Gold subscribers have to pay £5. Thirdly, because Microlink can be used both as a serious business tool *and* for entertainment, of which there is plenty.

BULLETIN BOARDS

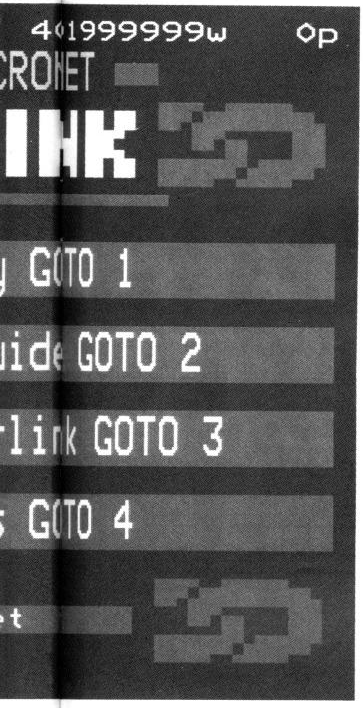
A bulletin board (BB) can best be compared to a community notice board. BBs are usually run by hobbyists in their own spare time on a home micro equipped with a disk drive and an auto-answer modem.

Typically, BBs will only allow one user at a time to browse through the files stored on the board. These can include messages from other users, general information, specialist sections, downloadable software and so on.

Compared to Micronet or Compunet, BBs are not technically brilliant, but they are by no means crude. One of the best things about using different BBs is that they're not bureaucratic, official, or run by money makers – and that makes a difference.

The UK currently has over 200 BBs that operate at regular times, and this number is growing. Basically there are two types of BB to choose from. There is the traditional scrolling type of BB and those using the Viewdata standard.

To access scrolling BBs you'll need terminal (often referred to as dumb



terminal) software. Most comms packages include this type of facility but, in case you are a Viewdata (Prestel) user who doesn't have this facility, there are lots of public domain (free) terminal programs available from user groups such as ICPUG or CLUB64. Terminal software does not give you any colour or graphics but it does allow you to logon to most types of BB.

The second type of BB operates using the Viewdata (Prestel) standard which presents information with colour and low–res graphics in a page format. Micronet/Prestel subscribers will not need to buy any additional software, but Compunet users will need the free Viewdata program which can be obtained through the system. Again, as with the dumb terminal software, most commercial comms software has a Viewdata mode.

Most BBs are operated at 300 baud. This means that you'll need a modem such as the Designer, Nightingale or Multimodem from Miracle Technology. All three will also allow you to access boards at 1200/75 in Prestel and scrolling formats. CBM Modem owners need not feel hard done by because many boards now allow access at 1200/75 baud, and some even operate at 1200/1200.

Logging On

Each BB has its own unique style and character. Facilities common to all types of BB include an E–Mail (Electronic Mail) option that enables you to send and receive messages. These messages can be sent privately to another user or be posted on the general board for everyone to see. Other features on BBs typically include free downloadable software.

Downloading can be achieved in several ways but by far the most popular system is the X–Modem format, so your comms package should have this option. Don't worry too much if it doesn't support X–Modem, as most BBs can transmit the software in ASCII (or PETASCII) format.

Another common feature to be found on BBs are SIGs – Special Interest Groups. These are areas which contain information on one particular subject such as a specific micro, comms in general, politics or whatever the SIG operator wants.

There are a few BBs running on Commodore machines, typically Amigas. You can set up and run your own BB with American BB public domain software, or by buying the BB Host software for the C64 from Y2 Computing for £69.

When using a BB it's worth remembering that the quality of a bulletin board is governed by its contents. The software and messages are all supplied by the users in the first place so don't be a parasite, as well as downloading programs and reading messages, why not put some up as well?

BBs To See

This table details a very small selection of BBs that are currently in operation on a 24 hour basis.

View means that you will need Prestel style software to access the board. **1200** means that you'll need scrolling software and a 1200/75 option modem such as the one from Commodore to gain access to the service. **300** means 300–300 baud access which needs scrolling software. CBM Modem users will *not* be able to access this type of board.

Name	Telephone	Rates
BABS 1	0394 276306	300
Brixton ITec	01–735 6153	View
Cardiff ITec	0222 464725	View
C–View	0702 546373	View
DUBBS Dublin £	0001 885634	300/1200
Dragon's Lair £	01–502 4543	300/1200
FBBS Swansea	0792 203953	300
Gnome at Home	01–888 8894	View
Grendel ABBS £	0532 620334	300/1200
Hackney BB	01–985 3322	View
Haunting Thunder	0752 364059	300
Infomatique £	0001 764942	300/1200
LABBS London £	0883 844164	300/1200
Lightfingers Place £	0202 485723	300/1200
Livingston BBs	050 638526	300
London BB	01–455 6607	300/1200
London Underground	01–863 0198	300/1200
Mactel	01–341 1719	300
Mailbox–80 (Liverpool)	051–428 8924	300/1200
Metrotel	01–941 4285	View
NKABBS £	0795 842324	300
Norview	0604 20441	View
TBBS Blandford	0258 54494	300

Entries marked with an asterisk are either run by Commodore machines, or have a SIG for Commodore owners.

RS232

Many people switch off when they hear the mention of the RS232 interface and related subjects. This article is aimed at clearing up some confusion and doubt.

By Steve Carrie

Some (if not most) of you will have heard by now of that favourite of all computer industry subjects, the RS232 communications standard. People have been known to go weak at the knees and hide when it is mentioned. Every day, it causes problems for computer engineers connecting up equipment such as printers and modems. It has even given rise to a lucrative business of building the so-called "break-out boxes" for monitoring and "fixing" RS232 lines.

If it is supposed to be an industry standard, why does it cause so much hassle? Every computer manufacturer has different ideas on how to build a computer; which devices to use, how big the screen should be, etc. It would seem that this train of thought also includes the RS232 standard.

Now, before I go on, let me say that the idea behind RS232 is great. A standard interface for connecting different types of hardware (including computers) together. RS232 is really useful in the field of telecommunications. Modems are usually connected to a computer via an RS232 link. You can connect two computers together and transfer programs between them (a technique often called "porting").

Unfortunately, things are not this simple. With different manufacturers having different ideas on how to implement the standard (Commodore is no exception) a great deal of confusion can arise when two pieces of hardware are to be connected together. Most of this confusion surrounds the way in which the control lines of an RS232 should be used. Thankfully, this does not concern us in this article since we will be using only a basic RS232 interface.

Basic RS232

As you may know, RS232 uses the serial method of data transmission. Information is sent bit by bit along a single wire to a receiving machine. Since data may flow in both directions, two wires plus a common return are required to make a basic RS232 communication line. The lines are usually connected to equipment by a 25-way D-type connector. Data leaving a computer exits via pin two and incoming data enters via pin three. The Ov return is connected to pin seven. This gives the "3-line" RS232 interface. There is no control over the flow of the data in either direction unless handled by the software (more on this later). An RS232 interface using more than these three lines is known as an "X-line" interface.

It is best to use a three or four core cable with a shield (we will see why in a moment) rather than separate wires.

For the purposes of this article, this is all we require. "Ah yes" you say, "that's all very well but my Commodore doesn't have a 25-way d-type connector let alone any RS232 interface". True it doesn't have a 25-way connector but it does have an RS232 interface. You mean you didn't know?

Commodore RS232

Since the time of the Vic 20, Commodore gas "programmed" in a limited form of RS232 port. I say programmed because the hardware device normally associated with RS232 communications, the Universal Asynchronous Receiver/Transmitter (UART), is not present in the circuitry of the Vic 20, C64, 64C, C128 and C128D. The omission of the C16 and Plus/4 is intended. The C16 cannot handle RS232 comms (we shall see why in a moment). The Plus/4 on the other

3-LINE RS2 INTERFACE	CONNECTIONS (25-way D-connector)	
pin	function	
2	Transmitted data	Sout
3	Received data	Sin
7	Common (Ov)	Gnd

hand is omitted for a different reason. This machine DOES have a UART.

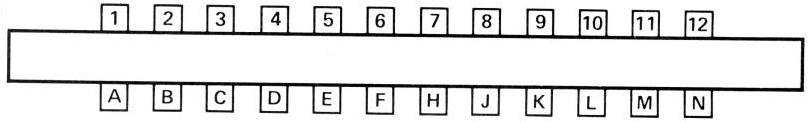
RS232 signals appear at the user port. This is exactly the reason why the C16 cannot handle RS232; it does not have a user port (a strange omission by Commodore. Anyone know why?). All the conversion is handled by the Operating System (Kernel). Thus (except in the case of the Plus/4) the user port coupled with the Kernel becomes almost the equivalent of the 6551 UART (the 6551 is the device that the software is supposed to emulate).

In the Vic the user port is controlled by a Versatile Interface Adaptor (VIA). In the other machines a Complex Interface Adaptor (CIA) is used (not a lot of difference as far as this article is concerned). Now before some of you run and hide at the mention of VIAs and CIAs, let me say that (thankfully) we do not have to program these devices directly. The Kernel handles all of the RS232 associated programming.

Figure 1 shows the RS232 associated connections to this port looking from the rear of the machine. Note that the user port uses a 0.156" edge connector (available from Maplin: order number BK74R). The top row of terminals are identified with numbers while the bottom row terminals are identified with letters. This means that it is very easy to connect the socket the wrong way up which could have disastrous consequences for your computer. The correct way is with the letters to the bottom as shown.

Connecting Up

The terminals labelled Sout (transmitted data) and Sin (received data) and GND (Ov common) are the three



Pin ID	Description	Abreviation
C	Received data	Sin
D	Request to send	RTS *
E	Data terminal rdy.	DTR *
H	Received line sig.	DCD *
K	Clear to send	CTS *
L	Data set ready	DSR *
M	Transmitted data	Sout
B	Received data	Sin
A	Protective ground	GND
N	Signal ground	GND
2	+5V supply	

*These lines are not used in 3-line mode

Signal ground is the Common return.
Protective ground for screening.

Maximum of 100mA may be drawn from the +5V supply

Fig 1

lines we need. Note however that there are TWO terminals labelled Sin. The reason for this lies with the way in which the RS232 on these machines works. One of the Sin lines is for data, the other is a flag or trigger input. Because the Commodore RS232 relies on Non-Maskable Interrupts (NMI) or interrupt request (IRQ) in the case of the Plus/4, there must be some form of detection to let the system know when data is being received.

When data is being received over the Sin line, the voltage level on this pin changes rapidly, causing interrupts to occur. The system software collects the data on the Sin line, placing it in an area of memory called the Receive Buffer. There is also a Transmit buffer for outgoing data. Thus the reception and transmission of data is basically transparent to the user. However, this method has its problems as we will see. The practical upshot of all this is that BOTH Sin terminals must be connected to the Sin line. Since they are next to one another, this is no great problem.

Also note the connection called PROTECTIVE GROUND. This terminal should be connected to the shield of your cable if you suspect any outside electrical interference of causing data errors.

While on the subject of making connections, you will have to use a soldering iron. Now don't run and hide (again). If you are not too sure about handling one, get an electronics hobbyist friend to do it for you.

It should go without saying that YOU SHOULD NEVER MAKE CONNECTIONS TO THE SOCKET WHILE IT IS CONNECTED TO THE COMPUTER. Always disconnect the socket BEFORE making or changing any connections and NEVER connect the socket to a line machine. ALWAYS switch off the power BEFORE plugging or unplugging!

OK. So you've connected your socket up and plugged it in the correct way... what now? If you only want to communicate with another Commodore (Vic, C64, Plus/4 or C128) then there is no great problem. The only thing to watch is that you must connect the Sout of one machine to the Sin of the other as in Figure 2 in order for them to exchange data (a bit obvious really!).

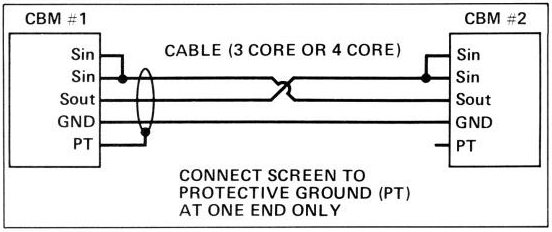


Fig 2

Commodore connections

If you don't intend connecting your machine to anything other than another Commodore, you can skip the next bit all together and get on with the programming. If you have a friend with one of the machines mentioned, you will be able to type messages to one another; handy if you live next door and you have a long piece of 3-core cable – your own mini-network! (Not recommended if you live across the street or several houses away!) How far you will be able to keep the machines apart depends very much on the operating conditions. Electrical interference may cause errors and there will come a point where the line is just too long. It's best to experiment with what you've got.

Non-Commodore Connections

This is where things get tricky. Connecting to anything other than a similarly equipped Commodore has its problems. This is because normal RS232 requires logic levels -12v (logic 1) and +12v (logic 0) as opposed to the Commodore RS232 logic levels of 0v (logic 0) and +5v (logic 1) (No that isn't a mis-print. RS232 logic is opposite voltage level-wise to your Commodore). However this problem can be overcome quite easily. There are various logic devices available specifically for this purpose. Among these are the RS423 line driver 3691 and RS423 line receiver 88LS120N. These devices convert between TTL logic levels and RS423 logic levels. RS423 is another (stricter) standard which is compatible with RS232 (at least to a certain extent). The beauty of using these devices is that they will operate from a +5v/-5v supply. This means that the user port's +5v output (pin 2: see Figure 1.) may be used for the +5v supply and all that is required is a -5v supply. These are the devices used by the BBC micro for it's RS423 port. Figure 3 shows the circuit required.

I can hear the groans of discontent. "I can't do that! I've never built an electronic circuit before!". If you do have an electronics hobbyist friend, try bribing him/her into building it for you.

I will not go into detail over the construction of the interface. I will assume that if you are building this, you know what you are doing. The 74LS00 device is used here as a logic inverter. I suggest that you use i.c. sockets so as not to subject the devices to heat which could damage them.

Power Supplies

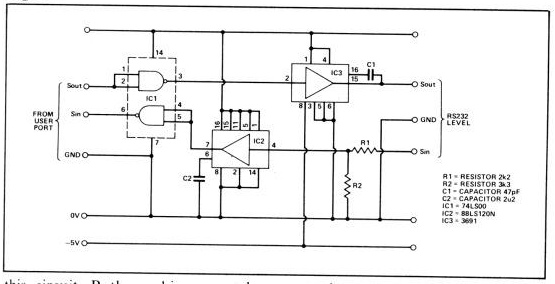
If you plan to use the mains (careful!) power supply circuit shown in Figure 4, I suggest that you use both the +5v and -5v supply circuits so as not to rely too much on the already overworked computer power supply. It goes without saying that no-one should use the mains unless they do know EXACTLY what they are doing.

The alternative battery supply cir-

cuit in figure 5 assumes that you are using the +5v supply from the computer. This circuit may also be used with one of those pocket calculator mains adaptors (like the Spectrum power supply) since the circuit regulates the voltage to -5v. The diodes shown prevent damage to the circuit if the battery/adaptor is incorrectly connected. Remember to disconnect the battery when you are not using the interface. This has the advantage of not requiring you to build a mains power supply.

Remember that you cannot connect an ordinary Commodore (without this interface) to one using this circuit. Both machines must be similarly equipped. Using this interface, you will be able to connect your Commodore to other computers such as the BBC and any suitably equipped IBM compatible. I have connected my C128 to my Televideo TS1605 (IBM compatible running MSDOS) and transferred files between them without any problems. This should also work with the Commodore PC10 and PC20 IBM compatibles. The only thing to watch for here is that most IBM compatibles need to have pins four and five (RTS and CTS) connected together as shown in Figure 6. The BBC will also require a similar connection. Because of RS232 differences between systems, I cannot say that this will work with every machine, but it will work with most. I have also connected my 128 up to a mainframe DECSYSTEM 2050 running at 1200 baud with absolute success.

Fig 3



Programming Commodore RS232

OK so you've got this far. You've linked your Commodore to another machine. What now?

Using the RS232 interface on a Commodore is much the same as using a printer or a disk drive. You must OPEN a logical file and use PRINT# and GET# to send and receive data. Note that you should NOT use INPUT# since there is a possibility that the system might hang by attempting to get input when it isn't there. Also be aware that on the Vic 20 and C64, the RS232 receive and transmit buffers are created at the top of Basic memory when the OPEN command is executed. (The buffers are permanently defined on the C128 and, I think, the Plus/4). This has the effect of wiping out any variables previously defined. (It performs a CLR). Therefore, you should make the OPEN RS232 statement the first in any program. Another, more serious problem occurs if your Basic program is very large. Then there is a chance that OPENing an RS232 channel may destroy the end of your program. So Beware!

The format for the OPEN statement is shown below:

OPEN lfn,dev,sec,CHR$ (control register)+CHR$ (command register)

where:
lfn = logical file number
dev = device (2 for RS232)
sec = secondary address (usually 0)
<control register>= see below
<command register>= see below

The RS232 interface is device number two. In order to operate correctly, the system requires you to tell it how fast you wish to transfer data (baud rate) and the format of the data number of stop bits, number of data bits, parity). The control register tells the system the baud rate, stop bits and data bits as in Table 2.

2400 baud is the maximum speed that is available on the Commodore RS232 on the C128. The C64 will allow up to 1200 so this is the maximum baud rate that I will use in the examples. If however you have any problems, try selecting 600 baud instead.

The command register defines other interface parameters as follows

bit	7	6	5	4	3	2	1	0
	S	D	D	R	B	B	B	B

S – stop bits
S
0 – one
1 – two

D – data bits
DD
00 – 8
01 – 7
10 – 6
11 – 5

B – baud rate
BBBB
0001 50
0010 75
0011 110
0100 134.5
0101 150
0110 300
0111 600
1000 1200 (C64 max)
1001 1800
1010 2400 (max)

R – Rclock
R (plus 4 only)
0 – external clock
1 – internal clock
(keep to 1)

Plus/4 capable of up to 19200 baud

Table 2

bit	7	6	5	4	3	2	1	0
	P	P	P	D	T	T	R	H

P – Parity D – duplex H – handshake
T – Transmit control R – receive control

PPP	D	H (non PLUS4)	H (PLUS4)
000 Disabled	0 Full	0 3-line	0 Receiver on
001 Odd	1 Half	1 X-line	1 Receiver off
011 Even			
101 Mark (1)			
111 Space (0)			

TT (Plus/4 only)	R (Plus/4 only)
00 IRQ Disabled; RTS=1; TX off	O IRQ on
01 IRQ Enabled; RTS=0; TX On	1 IRQ off
10 IRQ Disabled; RTS=0; TX On	
11 IRQ Disabled; RTS=0; BRK	

Table 3

Plus/4 users should refer to pages 207-211 of the user manual for further details on their machine's RS232 interface. This machine can handle transfer rates of up to 19200 baud.

Handshake determines how the interface will operate. We will be using 3-line. X-line is where you are using control lines as well as the data lines. This makes things a bit complex so we will stick to 3-line.

Duplex should be set to Full. This determines how the receive and transmit will behave.

Parity is a kind of error check. When data is received, the system checks it to see if it agrees with the parity. If not, the parity error bit in the variable ST (status) is set indicating some sort of error. These bits allow you to set the type of parity check required. Of course, both machines should be set to the same parity. In most cases, parity is not used and error checking is done in a different way (more on this later).

This may seem a little complex but it isn't really. Lets suppose that we want to open an RS232 channel to run at 1200 baud, eight data bits, one stop bit, no parity. The OPEN statement would be:

```
OPEN    2,2,0,CHR$(24)+CHR$(0)
(non Plus/4)
OPEN    2,2,0,CHR$(24)+CHR$(5)
(Plus/4)
```

and that is that! Simple, eh? In fact, if you stick to this particular format of eight data bits and no parity, you can't really go wrong. Just change the baud rate to suit.

Incidentally, the Commodore 64 programmers reference Guide tells you that the command register character is NOT required. It's probably safer to leave it in. My C128 sometimes won't work without it!

Using PRINT#AND GET# we can write a fairly simple terminal program running at 1200 baud. Running this on two machines (assuming its two Commodores) you will be able to type in a message on one keyboard and see it appear on the other machines display as well as your own. Figure 7 shows the program while Figure 8 shows a similar program for an IBM compatible machine running PCDOS or MSDOS and GWBASIC.

Figure 7 Commodore Basic mini terminal program

```
10 OPEN 2,2,0,CHR$(24)+CHR$(0)
11 REM PLUS4 USERS USE OPEN
2,2,0,CHR$(24)+CHR$(5)
20 PRINT "[CLS]"
30 GET#2,A$
40 IF A$<>"" THEN PRINT A$;
50 GET B$
60 IF B$<>"" THEN PRINT
B$;:PRINT#2,B$;
70 GOTO 30
```

Figure 8 GWBASIC mini terminal program

```
10 OPEN "COM1:1200,N,8,1" AS £1
20 CLS
30 IF LOC(1)=0 THEN 50
40 A$=INPUT$(1,#1):PRINT A$;
50 B$=INKEY$
60 IF B$<>"" THEN PRINT
B$;:PRINT#1,B$;
70 GOTO 30
```

Both programs check first for a character from the RS232 port. If one is found, it is output to the screen. If not, the program checks for a keyboard input. If found, the character is sent to the screen and also to the RS232.

Another interesting experiment when using an IBM compatible machine is to make the following change to the mini terminal program on the Commodore:

```
60 IF B$<>"" THEN PRINT£2,B$;
```

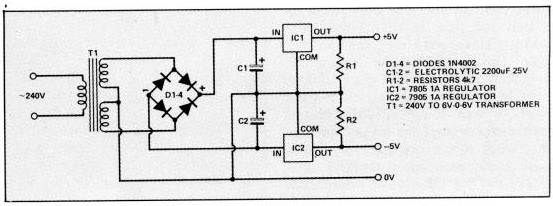


Fig 4

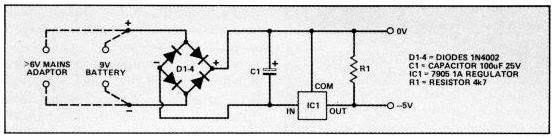


Fig 5

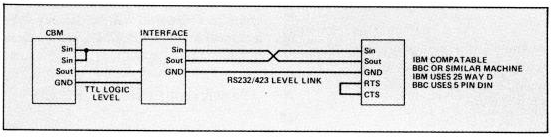


Fig 6

and run it. Now type the following on the IBM while in DOS:

```
MODE COM1:1200,N,8,1
CTTY COM1
```

(MODE is external so disk containing the command must be in the default drive).

This causes the IBM to think that its input/output device is the RS232 port instead of the console. This has the very odd effect of making the Commodore control the IBM! (although the character sets are different and some odd graphics characters may be printed). To return control to the IBM console, you must type CTTY CON on the Commodore.

Obviously, not many of you have access to an IBM, but this experiment does show up one very important problem with the Commodore's 3-line RS232 interface. If you take control of the IBM using the CTTY COM1 command again and type DIR which is the MSDOS command to display the directory, the first few lines are printed normally and then suddenly, there is a whole lot of garbage. If you slow down the baud rates to say 300, the problem may disappear. Why does this happen? Remember what I said about the Receive buffer? Well what happens is that data is received transparently over the RS232 lines and placed in the buffer. The buffer fills up quicker than Basic can empty it with the result that the buffer overflows and data is lost. Buffer overflow can be detectd by examining the ST status variable, but Basic is just too slow and you may still loose data.

Solutions

There are a few ways of solving this problem:

1. Use a slower baud rate to let Basic keep up.
2. Devise some form of software data flow control.
3. Connect control lines up and use an x-line interface.
4. Use machine code to process RS232 data.

Option 1 is not a good idea. Anyone who has used an RS 232 link at 300 baud will know why (yawn!).

Option 2 is better but requires programming which we will touch on later when we discuss file transfer.

Option 3 is not really practical here.

Option 4 is probably the best solution in this case. Data can be removed from the buffer much faster using machine code and this will be fine for the speeds at which we will be working (up to 1200 baud).

A very short machine code program can be written to handle the RS232 interface. The routine that follows is given in the form of a Basic loader. Change the variable AD to any free area in your computer's memory (the tape buffer is a good place). This program is for a C128 but it should work on any of the Commodore machines discussed.

```
10 OPEN 2,2,0,CHR$(24)+CHR$(0)
11 REM PLUS4 USERS: OPEN
2,2,0,CHR$(24)+CHR$(5)
20 AD=2816:CA=AD
30 READ BY
40 IF BY -1 THEN POKE
AD,BY:AD= AD+1:GOTO 30
50 :
60 PRINT CHR$(14):REM SWITCH
TO LOWERCASE'
70 SYS CA
80 :
90 :
100 DATA 162,2,32,198,255,32,228,255,
168
110 DATA 32,204,255,152,240,3,32,210,
255
120 DATA 32,228,255,240,233,72,
162,2,32
130 DATA 201,255,104,32,210,255,
32,204
140 DATA 255,56,176,217,-1
```

The only way out of this program is a RUNSTOP/RESTORE. Table 3 is the disassembled code with comments (addresses may differ from your version.

The program uses the kernal jumptable calls so it should be valid for all of the machines.

After the machine code has been placed in memory, the RS232 channel is opened with a file number of 2 (the channel number. If you change this you must change the two LDX instructions in the code) and the machine code routine called. Now the RS232 receive buffer does not get a chance to fill up so no data is lost. The OPEN statement could be replaced by the code in Table 4.

Character set translation

All this should be fine for Commodore

```
OBOO LDX #$02          ; Make channel 2 the current input device
OBO2 JSR $FFC6
OBO5 JSR $FFE4         ; Scan the RS232 buffer for 1 character
OBO8 TAY               ; Save data
OBO9 JSR $FFCC         ; Clear the channel
OBOC TYA               ; Restore the date
OBOD BEQ $OB12         ; If data is a null (a zero byte) then skip
OBOF JSE $FFD2         ; Output valid character
OB12 JSR $FFE4         ; Check for keyboard input
OB15 BEQ $OBOO         ; If none then recheck RS232
OB17 PHA; Save data
OB18 LDX #$02          ; Make channel 2 the current output device
OB1A JSR $FFC9
OB1D PLA               ; Restore data
OB1E JSR #FFD2         ; Send byte to RS232
OB21 JSR $FFCC         ; Clear channel
OB24 SEC               ; Force loop to check RS232 input
OB25 BCS $OBOO
```

Table 3

```
LDA #$02               ; Channel 2
LDX #$02               ; Device 2
LDY #$00               ; Secondary Addr. 0
JSR $FFBA              ; Set logical file
LDA £$01               ; 2 chars in filename
LDX # NAME             ; Pointer to filename
LDY # NAME             ; Pointer to filename
JSR $FFBD              ; Set filename
JSR $FFCO              ; Open RS232
Rest of code
.NAME:#B:24,0 ; Control and command register values (PLUS 4---
.NAME:#B:24,5) (#B: Is the byte directive of my C64 and C128
assemblers)
```

Table 4

to Commodore communications. It will also work with Commodore to IBM/BBC etc. comms but may yield strange results, the reason being that the Commodores do not use standard ASCII codes. They use what is sometimes called PETSCII, the Commodore PET being the first to use it. The most noticeable effect of this is that certain characters will appear on the Commodore's screen as graphics characters. The solution to this is to insert some form of translation table or routine into the code. Since data flows two ways, a routine or table would be required for each of input and output.

Two translation tables, each of 256 bytes, are required to handle outgoing and incoming data translations. The following program builds the translation tables and the machine code into memory starting at address AD. It needs at least 600 bytes to operate in so you need only change AD to the address you require. This version is for the C128 (Program Translate).

Program Translate

Line 5: AD=start address; BR=Control reg; CR=command reg.
Lines 10-100: Prepare tables
Lines 111-113: Setup name of channel (register images)
Lines 120-160: POKE receive table
Lines 170-200: POKE transmit table
Lines 210-230: POKE code to memory
Lines 240-270: Adjust table references in code
Lines 280-290: Adjust register image references in code
Lines 300-310: Select lowercase and call routine
Lines 330-370: Code data

Table 5 shows the disassembled machine code (addresses are offsets from the start address):

Basically, the operation is the same as before except:

1. The channel is opened from machine code.
2. Characters sent and received are translated.

Note that the backslash (\) character received will be displayed as a pound sign. The CBM Charset does not have a backslash.

Transferring files via RS232

This is probably the most useful application of RS232; transferring data between unalike machines. It is possible to transfer programs between two entirely different machines.

When using a 3-line interface, it is necessary to introduce some form of protocol into the software at both ends. This ensures that each machine understands exactly what the other intends to do.

A typical protocol exchange would look like a conversation between the two machines:

machine 1: Are you there?
machine 2: Yes.
machine 1: Requesting data transfer.
machine 2: OK.
machine 1: Transferring data (block of data sent)
machine 2: Received data.

and so on. The "are you there", "yes" etc. messages are actually 1 byte control codes. Normal ASCII has 32 control codes (codes 0-31). The actual usage varies from system to system and there are one or two protocol standards. For your own use, you don't have to follow any set protocol AS LONG AS BOTH MACHINES ARE USING THE SAME ONE. Figure 9 gives a list of ASCII code 0-31 and their meanings.

Note the two marked XON and XOFF. These you may recognise. XON/XOFF protocol is useful where large amounts of continuous data are being transferred. The receiving machine can send an XOFF code when it wants the transmitting machine to hold off sending data, and send an

XON when it wants to resume. This type of control is often used with dumb terminals to mainframes.

Another method of transferring data is to send it in blocks of 2-255 characters (usually 128 chars). This removes the need for XON/XOFF control because as each block is sent, the two machines exchange control codes. This method of transfer also allows error checking to be carried out on the data. One of the most popular error check methods is the Cyclic Redundancy Check (CRC). We won't go into this here as there is no real need for such a complex check with hard-wired RS232. CRC is really useful for Telecommunications via modems. Phone lines are noisy and data errors may easily result at high baud rates. The CRC error check allows the two machines at either end to check the data for errors, if an error is found, the receiving machine requests that the data is transmitted again.

When sending data using the block method, the software collects data bytes into "packets" of 128 bytes. Assuming the link is open, the transmitting machine (TM) sends a start-of-transmission code. The receiving machine (RM) replies with an acknowledge code. The TM then sends a start-of-block code followed by a data packet followed by an end-of-block code. The RM replies with an acknowledge code (assuming the data was received correctly) and the TM sends the next block. This continues unitl all data has been exchanged, whereupon the TM sends and end-of-transmission code and the link enters a wait-state.

The above description does not conform to any standard but will work. If error checks are included, the RM could send a data-error code if the data had been corrupted whereupon the TM would re-transmit the same data packet.

The program given in Figure 10 should run on any of the CBM machines discussed and is written in Basic. Since the comms are being controlled by the software, the receive buffer will not overflow. It allows a user to transfer a data file from one machine to another. The link is 1200 baud, eight data bits and no parity. It should be run on both machines. The control codes are shown in Table 6.

Note that I'm not using some of these as they should be used but, as I said earlier, as long as you stick to the same protocol on both machines, you'll be OK.

```
0000 LDA #$02          ; Logical channel 2
0002 LDX #$02          ; Device 2
0004 LDY #$00
0006 JSR $FFBA         ; Set Ifn
0009 LDA £$02          ; Name length (2 chars)
0008 LDX #<NAME        ; NAME is address of char string
000D LDY #>NAME
000F JSR $FFBD         ; Setnam
0012 JSR $FFCO         ; Opem
0015 LDX #$02          ; Make RS232 the input device
0017 JSR $FFC6
001A JSR $FFE4         ; Get a character
001D TAY; Save it
001E JSR $FFCC         ; Restore default device
0021 TYA
0022 BEQ 002A          ; If char =0 then no char rec.
0024 LDA RXTABLE,Y     ; Get PETSCII char from TXTABLE
0027 JSR $FFD2         ; Send to screen
002A JSR $FFE4         ; Check keyboard
002D BEQ 0015          ; No char, loop to check RS232
002F TAY               ; Index
0030 LDA TXTABLE,Y     ; Get ASCII equivalent
0033 PHA               ; Save
0034 LDX #$02          ; Make RS232 the default output
0036 JSR $FFC9
0039 PLA
003A JSR $FFD2         ; Output character
003D JSR $FFCC         ; Restore normal output
0040 SEC               ; Forced loop
0014 BCS 0015
```

Table 5

Possible Developments

The example programs I've given here do not show all of what may be achieved using the RS232 interface. It is possible (using a special version of the circuit described earlier) to have more than two machines running on a single 3-line RS232 commlink. This would allow a group of users (with special software written in machine code for maximum speed) to set up a mini-network. The possiblities are endless. I hope this article has helped to fuel your imagination. If you have any comments or ideas, please write to me c/o Your Commodore or leave a COURIER on Compunet ID SC12.

Table 6

Code	ASCII	Meaning in this program
5	ENQ	Attent/enquire
6	ACK	Acknowledge
1	SOH	Start transfer (transfer filename)
4	EOT	End transfer
2	STX	Start block
3	ETX	End block
26	SUB	Enter terminal mode (special seq.)
10	DLE	Exit terminal mode (data link escape)

Figure 9 ASCII Control Codes.

Code	ASCII	Function
0	NUL	Null
1	SOH	Start Heading
2	STX	Start text
3	ETX	End text
4	EOT	End transmission
5	ENQ	Enquire
6	ACK	Acknowledge
7	BEL	Rings terminal bell
8	BS	Backspace
9	HT	Horizontal tab
10	LF	Line feed
11	VT	Vertical tab
12	FF	Form feed
13	CR	Carriage return
14	SO	Shift out
15	SI	Shift in
16	DLE	Data link escape
17	DC1	Device control 1 XON
18	DC2	Device control 2
19	DC3	Device control 3 XOFF
20	DC4	Device control 4
21	NAK	Negative acknowledge
22	SYN	Synchronous idle
23	ETB	End transmission block
24	CAN	Cancel
25	EM	End medium
26	SUB	Special sequence
27	ESC	Escape
28	FS	File separator
29	GS	Group separator
30	RS	Record separator
31	US	Unit separator

Fig 10

```
PROGRAM: TRANSLATE


READY.

88  5 AD=4864:NA=AD:BR=24:CR=0
88  6 REM PLUS4 USERS USE BR=24:
    CR=5
B6  10 DIM F%(255),T%(255)
AF  20 FOR J=0 TO 64:T%(J)=J:NEX
    T
65  30 T%(10)=0:T%(20)=8
34  40 FOR J=65 TO 90:K=J+32:T%(
    J)=K:NEXT
23  50 FOR J=91 TO 95:T%(J)=J:NE
    XT
E5  60 FOR J=193 TO 218:K=J-128:
    T%(J)=K:NEXT
92  70 T%(146)=16:T%(133)=16
35  80 FOR J=0 TO 255
F7  90 K=T%(J)
EA  100 IF K<>0 THEN F%(K)=J:F%(
    K+128)=J
EC  110 NEXT
A1  111 POKE AD,BR
92  112 POKE AD+1,CR
DF  113 AD=AD+2
5B  120 RB=AD
F5  130 FOR X=0 TO 255
BC  140 POKE AD+X,F%(X)
14  150 NEXT
FA  160 AD=AD+256:TB=AD
20  170 FOR X=0 TO 255
C2  180 POKE AD+X,T%(X)
3C  190 NEXT
72  200 AD=AD+256:RT=AD
5E  210 RESTORE
92  220 READ BY
DB  230 IF BY<>-1 THEN POKE AD,B
    Y:AD=AD+1:GOTO 220
A4  240 HR=INT(RB/256):LR=RB-HR*
    256
AC  250 HT=INT(TB/256):LT=TB-HT*
    256
8C  260 POKE RT+37,LR:POKE RT+38
    ,HR
23  270 POKE RT+49,LT:POKE RT+50
    ,HT
C5  280 NH=INT(NA/256):NL=NA-NH*
    256
C5  290 POKE RT+12,NL:POKE RT+14
    ,NH
17  300 PRINT CHR$(14)
EF  310 SYS RT

C1  320 END
EB  330 DATA 169,2,162,2,160,0,3
    2,186,255,169,2,162,0,160,0,
    32,189,255,32,192
7B  340 DATA 255,162,2,32,198,25
    5,32,228,255,168,32,204,255,
    152,240,6,185,0
2A  350 DATA 0,32,210,255,32,228
    ,255,240,230,168,185,0,0,72,
    162,2,32,201,255,104
61  360 DATA 32,210,255,32,204,2
    55,56,176,210,-1

IOPROGRAM: FIGURE 10

READY.

2F  100 OPEN 2,2,0,CHR$(24)+CHR$
    (0)
C6  110 REM +4 OPEN 2,2,0,CHR$(2
    4)+CHR$(5)
42  120 :
8A  130 REM C64 MAY NEED TO RUN
    AT 600 BAUD
93  140 REM I.E. OPEN 2,2,0,CHR$
    (23)+CHR$(0)
AC  150 :
4E  160 GOSUB 2390:REM SETUP TAB
    LES
90  170 :
0A  180 PRINT"{CLR}";CHR$(14)
84  190 :
3D  200 REM ••••••••••••••••••••
    ••••••••••
55  210 REM MAIN LOOP STARTS HER
    E
49  220 REM ••••••••••••••••••••
    ••••••••••
FD  230 REM WAITS FOR RS232 ENQ
    CODE
6F  240 REM CTRL-F (FILE TRANSFE
    R)
0D  250 REM CTRL-Z (TERMINAL MOD
    E)
F2  260 REM CTRL-C (EXIT PROGRAM
    )
35  270 :
23  280 :
69  290 PRINT "{SAJWAITING {SE,S
    N,SQJ OR KEYPRESS"
13  300 GOSUB 1210: REM GET FUNC
    TION
F9  310 ON C GOSUB 400,530,800,3
    60

56  320 REM  GOSUB MODE,FIX,TERM
    OD,EXIT
39  330 GOTO 290
6F  340 :
65  350 :
74  360 REM EXIT PROGRAM
BF  370 CLOSE2:END
47  380 :
8D  390 :
CB  400 REM MODE
79  410 REM ENQ RECEIVED - WAIT
    FOR EITHER
9B  420 REM SS  (TERMINAL MODE R
    EQUEST)
F7  430 REM SOH (FILE TRANSFER R
    EQUEST)
83  440 :
B9  450 PRINT "{SE,SN,SQJ RECEIV
    ED.."
37  460 GOSUB 900 : REM SEND ACK

7C  470 GOSUB 1310: REM GET RECE
    IVE MODE
52  480 ON C GOSUB 640,730
65  490 RETURN
CF  500 :
C5  510 :
6F  520 REM FIX
CF  530 REM INITIATE FILE TRANSF
    ER
B5  540 GOSUB 2300:REM FILENAME
    FROM USER
B4  550 GOSUB 950 :REM SEND ENQ
AE  560 GOSUB 1150:REM WAIT FOR
    ACK
50  570 GOSUB 1050 :REM SEND SOH
    + FILENAME
D2  580 GOSUB 1150:REM WAIT FOR
    ACK
1E  590 PRINT "{SF}ILE TRANSFER
    BEGINS.."
A7  600 GOSUB 1760:REM RUN FILE
    TRANSMIT
B2  610 RETURN    :REM BACK TO M
    AIN LOOP
54  620 :
42  630 :
7D  640 REM RESPOND TO FILE TRAN
    SFER REQUEST
13  650 PRINT "{SF}ILE TRANSFER
    REQUEST ..."
BC  660 FR$=""
97  670 GOSUB 1380:REM GET NAME
    FROM RS232
3C  680 GOSUB 900 :REM SEND ACK
BB  690 GOSUB 1980:REM FILE RECE
```

```
    IUE
74  700 RETURN     :REM BACK TO M
    AIN LOOP
F2  710 :
EB  720 :
FE  730 REM RESPOND TO TERMINAL
    MODE REQ.
67  740 PRINT "CSI]ERMINAL MODE
    REQUEST..."
F2  750 GOSUB 900 :REM SEND ACK
B0  760 GOSUB 1520:REM RUN TERMI
    NAL MODE
2F  770 RETURN     :REM BACK TO M
    AIN LOOP
35  780 :
23  790 :
B6  800 REM INITIATE TERMINAL MO
    DE
B9  810 PRINT "CSI]NITIATING TER
    MINAL MODE"
3D  820 GOSUB 950 :REM SEND ENQ
99  830 GOSUB 1150:REM WAIT FOR
    ACK
10  840 GOSUB 1000 :REM SEND SS
A5  850 GOSUB 1150:WAIT FOR ACK
B9  860 GOSUB 1520:REM RUN TERMI
    NAL MODE
9B  870 RETURN     :REM BACK TO M
    AIN LOOP
49  880 :
47  890 :
BB  900 REM SEND ACK
40  910 PRINT#2,CHR$(6);
15  920 RETURN
9F  930 :
95  940 :
34  950 REM SEND ENQ
97  960 PRINT#2,CHR$(5);
43  970 RETURN
ED  980 :
D8  990 :
5A  1000 REM SEND SS
E0  1010 PRINT#2,CHR$(26);
71  1020 RETURN
3D  1030 :
2E  1040 :
C1  1050 REM SEND SOH + FILENAME

02  1060 PRINT#2,CHR$(1);
E9  1070 PRINT#2,CHR$(FL);
30  1080 FOR X=1 TO FL
7E  1090 PRINT#2,CHR$(T%(ASC(MID
    $(F$,X,1))));
D2  1100 NEXT
B6  1110 PRINT#2,CHR$(T%(ASC(T$)
    ));
EA  1120 RETURN
54  1130 :
42  1140 :
27  1150 REM WAIT FOR ACK (WACK)

F3  1160 GET#2,A$
95  1170 IF A$<>CHR$(6) THEN 116
    0
2E  1180 RETURN
90  1190 :
8E  1200 :
39  1210 REM GETFUNCTION
CF  1220 GET#2,A$
14  1230 IF A$=CHR$(5) THEN C=1:
    RETURN
00  1240 GET A$
B6  1250 IF A$=CHR$(6) THEN C=2:
    RETURN
03  1260 IF A$=CHR$(26) THEN C=3
    :RETURN
A3  1270 IF A$=CHR$(3) THEN C=4:
    RETURN
2E  1280 GOTO 1210
35  1290 :
23  1300 :
AB  1310 REM GET ENQ MODE
AC  1320 GET#2,A$
A5  1330 IF A$=CHR$(1) THEN C=1:
    RETURN
CF  1340 IF A$=CHR$(26) THEN C=2
    :RETURN
64  1350 GOTO 1320
6F  1360 :
65  1370 :
4D  1380 REM GET FILENAME FROM R
    S232 SOH
5E  1390 GET#2,A$:IF A$="" THEN
    1390
1C  1400 A=ASC(A$)
E4  1410 FOR X=1 TO A
B0  1420 GET#2,A$:IF A$=""THEN 1
    420
47  1430 FR$=FR$+CHR$(R%(ASC(A$)
    ))
27  1440 NEXT
C3  1450 GET#2,T$:IF T$="" THEN
    1450
3C  1460 E$=",S,W"
BB  1470 T$=CHR$(R%(ASC(T$)))
D5  1480 IF T$="(SP]" OR T$="P"
    THEN E$=",P,W"
59  1490 RETURN
DB  1500 :
D1  1510 :
83  1520 REM TERMINAL MODE
94  1530 REM REMAIN IN TERMINAL
    MODE UNTIL
C3  1540 REM EITHER DLE FROM RS2
    32
9C  1550 REM OR CTRL-C KEYSTROKE

24  1560 :
CA  1570 PRINT "CSE]NTERING TERM
    INAL MODE."
15  1580 GET#2,A$
16  1590 IF A$="" THEN 1620
BA  1600 IF A$=CHR$(16) THEN GOT
    O 1710
06  1610 PRINT CHR$(R%(ASC(A$)))
    ;
18  1620 GET#2,A$
E3  1630 IF A$="" THEN 1580
4B  1640 IF A$=CHR$(3) THEN GOTO
    1680
B4  1650 PRINT#5,:PRINT#2,CHR$(T
    %(ASC(A$)));
A7  1660 GOTO 1580
B6  1670 :
3F  1680 REM CTRL-C KEYSTROKE
B2  1690 PRINT#2,CHR$(16);
90  1700 :
A1  1710 REM EXIT REQUEST RECEIV
    ED
EA  1720 PRINT "CSI]ERMINAL MODE
    ENDS..."
46  1730 RETURN
EB  1740 :
E6  1750 :
01  1760 REM FILE TRANSMIT
22  1770 OPEN 3,8,3,FI$
25  1780 BL=1:SS=0
3E  1790 :
2D  1800 C=0:CH$="":BL$="":PRINT
    "BLOCK";BL;
5A  1810 GET#3,CH$:IF I$="I" THE
    N CH$=CHR$(T%(ASC(CH$)))
AC  1820 IF SI THEN FOR X=CH TO
    128:BL$=BL$+CHR$(0):NEXT:SS=
    -1:GOTO 1850
BA  1830 BL$=BL$+CH$
63  1840 C=C+1:IF C<128 THEN 181
    0
0C  1850 PRINT#2,CHR$(2);
70  1860 PRINT#2,BL$;
07  1870 PRINT#2,CHR$(3);
2F  1880 PRINT ".128 BYTES";
B3  1890 GOSUB 1150
6C  1900 PRINT ".[SO,SK]."
58  1910 IF NOT SS THEN BL=BL+1:
    GOTO 1800
BD  1920 :
3E  1930 PRINT#2,CHR$(4);
6B  1940 CLOSE 3
EB  1950 RETURN    : REM BACK TO
    MAIN LOOP
95  1960 :
83  1970 :
0B  1980 REM RECEIVE FILE
EC  1990 PRINT "CSF]ILE ";FR$;"
    OF TYPE ";I$
77  2000 FI$=FR$+E$
51  2010 OPEN 3,8,3,FI$
7B  2020 BL=1
CF  2030 :
3B  2040 CH$="":BL$=""
D9  2050 GOSUB 2240:IF R$=CHR$(4
    ) THEN 2190
A5  2060 IF R$<>CHR$(2) THEN 205
    0
AU  2070 PRINT "CSB]LOCK ";BL;".
    ";
A1  2080 FOR X=1 TO 128
E0  2090 GET#2,CH$:IF LEN(CH$)=0
    THEN CH$=CH$+CHR$(0)
F5  2100 IF I$="CSI]" OR I$="I"
    THEN CH$=CHR$(R%(ASC(CH$)))
E1  2110 BL$=BL$+CH$
D2  2120 NEXT
7B  2130 GOSUB 2240:IF R$<>CHR$(
    3) THEN 2130
5C  2140 PRINT#3,BL$;" BYTES ";
DB  2150 BL=BL+1
B4  2160 GOSUB 900:PRINT ".[SO,S
    K].";LEN(BL$)
A0  2170 GOTO 2040
B6  2180 :
5B  2190 PRINT "CSI]RANSFER COMP
    LETE."
13  2200 CLOSE 3
1A  2210 RETURN  : REM BACK TO M
    AIN LOOP
BE  2220 :
B4  2230 :
CB  2240 REM WAIT FOR ETX OR EOT

A6  2250 GET#2,R$
CF  2260 IF R$=""THEN 2250
6B  2270 RETURN
CA  2280 :
C0  2290 :
1F  2300 REM GET FILENAME FROM U
    SER
74  2310 INPUT "CSF]ILENAME TO T
    RANSFER.";F$
57  2320 INPUT "(T)EXT (CSS,SE,S
    D)) OR (P)ROGRAM (CSP,SR,SD)
    ";I$
15  2330 E$=",S,R"
0C  2340 IF I$="P" THEN E$=",P,R
    "
31  2350 FI$=F$+E$:FL=LEN(F$)
CF  2360 RETURN
71  2370 :
6F  2380 :
A9  2390 REM SETUP TRANSLATION T
    ABLES
FF  2400 PRINT "CSS]ETTING UP..."
D7  2410 DIM T%(255),R%(255)
F0  2420 FOR J=0 TO 64:T%(J)=J:N
    EXT
3A  2430 T%(10)=0:T%(20)=8
C3  2440 FOR J= 65 TO 90:K=J+32:
    T%(J)=K:NEXT
60  2450 FOR J=91 TO 95:T%(J)=J:
    NEXT
54  2460 FOR J=193 TO 218:K=J-12
    8:T%(J)=K:NEXT
05  2470 T%(146)=16:T%(133)=16
22  2480 FOR J=0 TO 255
2C  2490 K=T%(J)
CF  2500 IF K<>0 THEN R%(K)=J:R%
    (K+128)=J
55  2510 NEXT
6F  2520 RETURN
4F  2530 GET A$
5A  2540 IF A$="" THEN 2530
64  2550 PRINT ASC(A$)
25  2560 GOTO 2530
```

Talking through your RS232

There's more to this interface than meets the eye. Do not be deceived by first impressions.

By Eric Doyle

An RS232 interface is hardly the most exciting product as far as appearance is concerned. For your money all you appear to get is two connectors with a length of cable to separate them. Don't be deceived by appearances, this could be one of the most gratifying additions for your Commodore.

An RS232 is the Commodore's link with the real world via the user port, the most ignored socket on the back of any recent Commodore machine. Via this outlet you can communicate with Compunet, link up with another C64, access a wider range of printers or perform electronic wizardry with a whole series of domestic equipment.

I can already hear the muttering about the user port being RS232 and you're not wrong but the great drawback is that the Commodore implementation only provides a 0/+5V output and most true RS232 equipment requires a +/-12V supply. York Electronic Research's interface does the necessary conversion for you.

Value for Money?

For your money you also get a disk or tape which initialises the port for use and will also convert the 64 into a terminal emulator for use with a suitable modem.

It is obvious by reading the manual that the modem link and printer interface are considered to be the most important uses for the unit and the detail is sufficient to get you up and running. As far as connecting two 64s together, the detail is sketchy and a few wiring diagrams would avoid the possibility of the keen amateur blowing up two 64s in one fell swoop!

RS232 communications have a language all their own. Handshakes, baud rate, parity and duplex form the new vocabulary which not only confuses the newcomer but also has an off-putting effect on those considering modem communications. The new syntax is explained quite well in a concise way which proves that the jargon is no more than part of the rites of telecommunication.

Handshaking is a way in which one terminal tells the other that it is about to send data and the other terminal says it is ready to receive. Baud rate is

the speed at which information is transmitted. Quite often the speed of transmission can be different to the speed at which information is received. In human terms this means that one machine speaks more slowly than the other.

Parity is a check for data corruption. Anyone who has used a telephone knows how a bad line means that conversation can be difficult. This is also true in the comms world. Parity does not solve the problem but it can let you know that something is wrong. Information is sent in binary form, a string of ones and zeros in bursts of eight digits. If you're working on even parity, seven of the bits hold the information for a single character, the computer counts the number of ones in that character and if this is an odd number the eighth bit will be a one if not it will transmit a zero. The receiving terminal knows that if there is an odd number of ones in the transmitted byte something has gone wrong. Similarly some systems use parity based on odd numbers.

Full duplex is when both machines are able to talk simultaneously to one another and half duplex means transmission in one direction must end before the machine can receive.

The Relevant Software

The software for YER's RS232 interface supports any of these systems via a simple menu selection system. The Set Up program is mainly for use with RS232 printers and your only real concern is the baud rate. If the printer does not tell you which rate to use it will not damage the machine to experiment a little. The worst that can happen is that the printer will fail to respond.

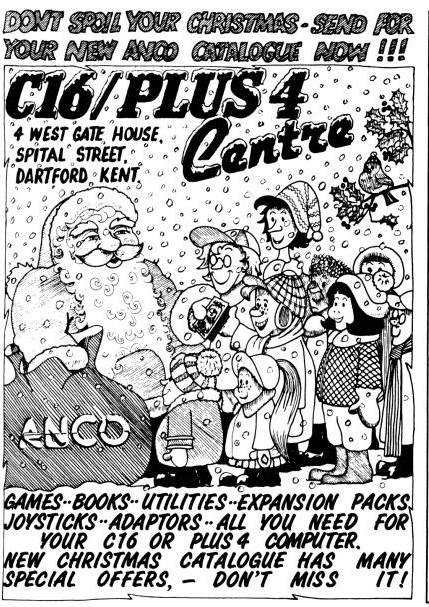
A handy troubleshooting section should solve most of the problems with printers, but if a baud rate over 2400 is required the 64 cannot respond fast enough. Luckily most printers have switches to select various rates so all may not be lost.

Limitations

The one drawback of the Terminal Emulator is that it can't handle Viewdata/Prestel style graphics which limits your entry into the comms world slightly. Apart from this, the software menu is flexible enough for any system you'd want to talk to and cuts down the sophistication and cost of the modem required.

York Electronic Research have provided a service which to most Commodore owners never realised they required. RS232 interfacing is the subject of several books and articles which benefits a sector of users who wish to combine an interest in amateur electronics with their computer hobby. For these people YER can supply the missing link.

Touchline:
Supplier: *York Electronic Research.*
Tel: *(0904) 610722.* ***Price:*** *£29.99.*



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*Please specify.

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RS232 On The Plus/4

19,200 baud on the Plus/4? A Beeb listing in a Commodore mag? Are we kidding you? We certainly aren't. . .

By R C Hemes

Surprising though it may seem, the Plus/4 is a lot faster at communicating using RS232 than the 64. This is due to the 64 using a software simulation to copy the action of the 6551 ACIA IC which would normally be used for RS232. Indeed, the 64 is so slow that it often misses characters even at the leisurely 300 baud.

The Plus/4 on the other hand, has a 6551 which handled all the RS232 signals except CTS which is dealt with by a 6529. Also, there is no need to connect S-into pin B (as suggested in 'Interfacing with the RS232', *Your Commodore*, January 1987, p 82-90).

The Plus/4 software has the ability to use XON/XOFF flow control with the user's choice of XON/XOFF characters. These are normally CTL/S for XOFF and CTL/Q for XON. This facility is used to stop the remote device from transmitting more data when the receiving device has no more room in its input buffer, and to restart the remote device when the receiving device has removed enough characters from its buffer.

The Plus/4 has a dedicated 64-byte RS232 user receive buffer located at $03F7, to $0436, and a one byte system transmit buffer at $S07CF which is used to hold the current XON/OFF character.

If the ACIA is configured, the interrupt handler will call two subroutines to handle RS232 interrupts. The first routine:
Checks for a remote device initiated XON/XOFF sequence and handles it appropriately;
Checks user receive buffer is full, and if so then ignores this received character and returns;
If there is room for eight characters, then it sets various flags, and stores XOFF character from $FD into the system transmit buffer and puts the received character in the user input buffer.
The second routine called will:
Check ACIA transmit buffer empty

```
  5 REM BBC PROGRAM TO TEST PLUS/4 TO BBC RS232 AT 19200 BAUD
 10 *FX7,8
 20 *FX8,8
 30 *FX3,5
 40 *FX2,1
 50 FOR Y=0TO7
 60 A$=INKEY$(0)
 70 IF A$<>CHR$(19) THEN100
 80 A$=INKEY$(0)
 90 IF A$<>CHR$(17) THEN80
100 PRINT STR$(Y);
110 NEXTY
120 GOTO 50
```

```
  5 REM PLUS/4 PROGRAM TO TEST PLUS/4 TO BBC RS232 AT 19200 BAUD
 10 OPEN2,2,0,CHR$(31)+CHR$(5)
 20 POKEDEC("FC"),17:POKEDEC("FD"),19
 30 GET#2,A$
 40 IFA$<>"" THENPRINTA$;
 50 GOTO 20
```

Listings 1 and 2: programs for the BBC B (top) and the Plus/4 to show transmission from the BBC to the Plus/4 at 19,200 baud.

and return if not;
Check for CTS signal low, and return if so;
Check input buffer full flag, and send either XOFF or XON as appropriate.

It is the job of the RS232 portion of the CHRIN routine to reset the user buffer-full and remote-paused flags and initiate sending of the XON character.

Note that the XON/XOFF protocol is used only if the user has POKEd the XON/XOFF characters into $FC and $FD respectively; if these two locations are zero then characters received when the buffer is full are ignored.

And The Proof. . .

I have tested the Plus/4 connected to a BBC Model B, running at 19,200 baud, with the BBC sending the Plus/4 at full speed, and over a one hour period not a single character was lost by the Plus/4. The two programs for the Plus/4 and the BBC are shown in Listing 1 and 2.

Unfortunately, there is a bug in the Plus/4 ROM RS232 routines, which causes the Plus/4 to crash immediately after it has transmitted the first XON resume character, and the rest of this article describes how to fix this bug.

First we need to make our own copy of the Kernal ROM, and then patch the incorrect code. This is not so easy. . . Listing 3 is a listing of a Basic Program and a machine code program which copy the ROM down into RAM, cause the new version of the Kernal to be executed, and inhibit switching back to ROM. The top of memory pointers are also reset to $7FFF, and the bad code in the RAM copy is fixed. The Basic program must be typed in **Exactly** as shown, with **No** additional spaces, etc, as the machine code program is immediately above it at $4163.

A disassembly of the RS232 code in the Kernal is included in figure 3.

```
1 POKE51,0:POKE53,0:POKE55,0:POKE52,128:POKE54,128:POKE56,128:CLR

2 SYS4163

3 NEW
```

Listing 3A: Basic program to reset top of memory pointers and call machine code program to copy the Kernal and Basic from ROM to RAM, and change all references to $FF3E to $FF3F.

Listing 3B: Machine code program to copy ROM to RAM and inhibit switching to ROM.

```
                        ORG     $1043
1043 78                 SEI
1044 8D 3E FF           STA     $FF3E     ;SWITCH TO ROM
1047 A0 00              LDY     £$00
1049 B9 00 80   LP1     LDA     $8000,Y   ;COPY PART 1 OF ROM TO RAM
104C 99 00 80           STA     $8000,Y   ;$8000 TO $FCFF
104F C8                 INY
1050 D0 F7              BNE     LP1

1052 EE 4B 10           INC     LP1+2

1055 EE 4E 10           INC     LP1+5

1058 AD 4E 10           LDA     LP1+5

105B C9 FD              CMP     £$FD

105D D0 EA              BNE     LP1

105F A0 40              LDY     £$40

1061 B9 00 FF   LP2     LDA     $FF00,Y   ;COPY PART 2 OF ROM TO RAM

1064 99 00 FF           STA     $FF00,Y   ;$FF40 TO $FFFF

1067 C8                 INY

1068 D0 F7              BNE     LP2
```

```
106A A9 3F        LDA     £<$FF3F   ;INHIBIT ALL ROM SWITCHING
106C 8D 82 04     STA     $0482
106F 8D 9E 04     STA     $049E
1072 8D AC 04     STA     $04AC
1075 8D B7 04     STA     $04B7
1078 8D C2 04     STA     $04C2
107B 8D CD 04     STA     $04CD
107E 8D D8 04     STA     $04D8
1081 8D E3 04     STA     $04E3
1084 8D E1 07     STA     $07E1
1087 8D 32 81     STA     $8132
108A 8D 4E 81     STA     $814E
108D 8D BB CF     STA     $CFBB
1090 8D F7 FF     STA     $FFF7
1093 8D 3F FF     STA     $FF3F     ;SWITCH TO RAM
1096 A9 4C        LDA     £$4C      ;PUT JMP $CEC5 AT $EB1B
1098 8D 1B EB     STA     $EB1B
109B A9 C5        LDA     £<$CEC5
109D 8D 1C EB     STA     $EB1B+1
10A0 A9 CE        LDA     £>$CEC5
10A2 8D 1D EB     STA     $EB1B+2
10A5 A2 06        LDX     £$06      ;COPY CODE TO PATCH AREA
10A7 BD B2 10  LP3  LDA   PCH,X
10AA 9D C5 CE     STA     $CEC5,X
10AD CA           DEX
10AE 10 F7        BPL     LP3
10B0 58           CLI
10B1 60           RTS
10B2 8D CF 07  PCH  STA   $07CF     ;SAVE CH IN SYSTEM O/P BUFFER
10B5 68           PLA               ;PULL NEXT USER INPUT CHAR
10B6 4C 1E EB     JMP     $EB1E     ;RETURN TO RS232 RCUTINE
```

Listing 4: The Plus/4 RS232 routines.

```
        TRANSMIT RS232 CHARACTER, ENTERED FROM IRQ ROUTINE AT $CE28
EA5B AD D4 07 SEA5B   LDA $07D4       ;GET ACIA STATUS
EA5E 29 10            AND £$10        ;TX DATA REG FLAG
EA60 F0 32            BEQ BEA94       ;->TX DATA REG NOT EMPTY
EA62 AD 10 FD         LDA $FD10       ;6529B
EA65 29 02            AND £$02        ;CTS PRESENT
EA67 F0 2B            BEQ BEA94       ;->NO, DO NOT TRANSMIT
EA69 A2 00            LDX £$00
EA6B 2C DC 07         BIT $07D0       ;SYSTEM INPUT BUFFER FULL?
EA6E 10 09            BPL BEA79       ; -> NO
EA70 AD CF 07         LDA $07CF       ;YES, GET CHAR FROM SYS BUF
EA73 8E D0 07         STX $07D0       ;CLEAR SYSTEM BUFFER FULL FLG
EA76 4C 89 EA         JMP JEA89
EA79 2C CE 07 BEA79   BIT $07CE       ;USR INPUT BUFFER FULL?
EA7C 10 16            BPL BEA94       ; -> NO
EA7E 2C D6 07         BIT $07D6       ;YES, LOCAL PALSE SET?
EA81 30 11            BMI BEA94       ; -> YES
EA83 AD CD 07         LDA $07CD       ;NO,GET USER CHAR TO SEND
EA86 8E CE 07         STX $07CE       ;CLEAR USER BUFFER FULL FLAG
EA89 8D 00 FD JEA89   STA $FD00       ;ACIA TRANSMIT REG
EA8C AD D4 07         LDA $07D4       ;GET ACIA STATUS REG
EA8F 29 EF            AND £$EF        ;SAVE ONLY TRANSMIT DATA REG
EA91 8D D4 07         STA $07D4       ; STATUS BIT
EA94 60       BEA94   RTS
        CHECK FOR RECEIVED RS232 CHARACTER ENTERED FROM IRQ AT $CE25
EA95 AD D4 07 SEA95   LDA $07D4       ;GET ACIA STATUS REG
EA98 29 08            AND £$C8        ;RECEIVE DATA REG FLAG
EA9A F0 54            BEQ BEAF0       ;->RX DATA REG NOT FULL
EA9C AD D4 07         LDA $07D4       ;GET RX DATA REG FLAG
EA9F 29 F7            AND £$F7        ;SAVE ONLY RX DATA REG
```

```
EAA1 8D D4 07          STA $07D4       ; STATUS BIT
EAA4 AD 00 FD          LDA $FD00       ;GET ACIA RCV REGISTER
EAA7 F0 19             BEQ BEAC2       ; -> NO DATA OR NULL
EAA9 8D D5 07          STA $07D5       ;SAVE THE CHAR
EAAC C5 FC             CMP $FC         ;IS IT XON CHARACTER?
EAAE D0 07             BNE BEAB7       ; -> NO
     RECEIVED XON REMOTE END WANTS US TO RESTART TRANSMISSION
EAB0 A9 00             LDA #$00        ;YES, CLEAR
EAB2 8D D6 07          STA $07D6       ;  LOCAL PAUSE FLAG
EAB5 F0 39             BEQ BEAF0       ;    AND RETURN
EAB7 C5 FD    BEAB7    CMP $FD         ;IS IT XOFF CHARACTER?
EAB9 D0 07             BNE BEAC2       ; -> NO
     RECEIVED XOFF CHARACTER, REMOTE END WANTS US TO STOP TRANSMISSION
EABB A9 FF             LDA #$FF        ;YES, SET LOCAL
EABD 8D D6 07          STA $07D6       ;  PAUSE FLAG
EAC0 D0 2E             BNE BEAF0       ;    AND RETURN
EAC2 AD D3 07 BEAC2    LDA $07D3       ;NCHARS IN USR INPUT BUFFER
EAC5 C9 3F             CMP #$3F        ;FULL?
EAC7 F0 27             BEQ BEAF0       ; -> YES
EAC9 C9 38             CMP #$38        ;NO, AT THRESHOLD FOR XOFF?
EACB D0 0F             BNE BEADC       ; -> NO
EACD A5 FD             LDA $FD         ;YES, GET XOFF CHAR
EACF F0 0B             BEQ BEADC       ; -> NO XOFF CHAR DEFINED
EAD1 8D CF 07          STA $07CF       ;PUT IN SYSTEM O/P BUFFER
EAD4 A9 FF             LDA #$FF
EAD6 8D D0 07          STA $07D0       ;SET SYSTEM BUFFER FULL FLG
EAD9 8D D7 07          STA $07D7       ;SET REMOTE PAUSE FLAG
EADC AE D1 07 BEADC    LDX $07D1       ;GET USER I/P BUFFER INDEX
EADF E8                INX             ;ADD ONE
EAE0 8A                TXA
EAE1 29 3F             AND #$3F        ;MAKE INDEX MOD 64 AND
```

```
EAE3 8D D1 07          STA $07D1       ; STORE NEW INDEX
EAE6 AA                TAX             ;GET INDEX IN .X
EAE7 AD D5 07          LDA $07D5       ;GET RECEIVED CHAR
EAEA 9D F7 03          STA $03F7,X     ; AND STORE IN USER I/P BUF
EAED EE D3 07          INC $07D3       ;NCHARS IN USR I/P BUFFER
EAF0 60        BEAF0   RTS
     CONTINUATION OF CHRIN FOR RS232 DEVICE
EAF1 AD D3 07 SEAF1    LDA $07D3       ;NCHARS IN USR I/P BUFFER
EAF4 F0 34             BEQ BEB2A       ; -> EMPTY
EAF6 08                PHP             ;SAVE INHIBIT STATUS
EAF7 78                SEI
EAF8 AE D2 07          LDX $07D2       ;I/P Q FETCH INDEX
EAFB E8                INX             ;ADD ONE
EAFC 8A                TXA
EAFD 29 3F             AND #$3F        ;MAKE MOD 64
EAFF 8D D2 07          STA $07D2       ; AND RESTORE IT
EB02 28                PLP             ;RECOVER INHIBIT BIT
EB03 AA                TAX             ;I/P Q FETCH INDEX
EB04 BD F7 03          LDA $03F7,X     ;GET NEXT CHAR FROM I/P BUF
EB07 48                PHA             ; ONTO STACK
EB08 CE D3 07          DEC $07D3       ;DECREMENT NCHARS IN BUF
EB0B AD D3 07          LDA $07D3       ;GET NCHARS IN I/P BUF
EB0E C9 08             CMP #$08
EB10 D0 19             BNE BEB2B       ; -> NCHARS <> 8
EB12 2C D7 07          BIT $07D7       ;IS REMOTE PAUSE FLAG SET?
EB15 10 14             BPL BEB2B       ; -> NO
EB17 A5 FC             LDA $FC         ;IS XON CHAR DEFINED?
EB19 F0 10             BEQ BEB2B       ; -> NO
EB1B 8D CF 07          STA $07CF       ;YES, PUT IT IN SYS O/P BUF
     HERE IS THE BUG. THE NEXT CHARACTER TO BE RETURNED TO THE USER
     IS THE TOP ENTRY ON THE STACK. A PLA SHOLD BE DONE HERE.
```

```
EB1E 38                 SEC
EB1F 6E D0 07           ROR $07D0       ;RESET SYS BUFFER FULL FLAG
EB22 4E D7 07           LSR $07D7       ; AND REMOTE PAUSE FLAG
EB25 2C D8 07 SEB25     BIT $07D8       ;ACIA PRESENT?
EB28 10 0B              BPL BEB35       ; -> NO
EB2A 48         BEB2A   PHA             ;YES, SAVE NEXT CHAR TO SEND
EB2B AD D4 07 BEB2B     LDA $07D4       ;GET ACIA STATUS REG
EB2E 29 4F              AND #%01001111  ; SAVE DSR
EB30 49 40              EOR #%01000000  ;  AND INVERT IT
EB32 85 90              STA $90         ;   STORE IN KERNAL ST WORD
EB34 68                 PLA             ;RECOVER CHAR READ
EB35 18         BEB35   CLC             ;FLAG NO ERROR
EB36 60                 RTS
     SETUP USER CHARACTER TO TRANSMIT
EB37 2C CE 07 BEB37     BIT $07CE       ;USER XMIT BUFFER FULL?
EB3A 30 FB              BMI BEB37       ;->YES, WAIT FOR IT TO EMPTY
EB3C 8D CD 07           STA $07CD       ;NO, STORE USER O/P CHARACTER
EB3F 38                 SEC             ; IN USER XMIT BUFFER, SET
EB40 6E CE 07           ROR $07CE       ;  USER XMIT BUFFER FULL FLAG
EB43 4C 2A EB           JMP BEB2A
     INITIALIZE RS232 CONSTANTS AND ACIA
EB46 A9 00      SEB46   LDA #$00        ;CLEAR ALL
EB48 A2 0B              LDX #$0B        ; RS232
EB4A 9D CD 07 BEB4A     STA $07CD,X     ;  VARIABLES
EB4D CA                 DEX
EB4E 10 FA              BPL BEB4A
EB50 8D 01 FD           STA $FD01       ;RESET ACIA
EB53 85 FC              STA $FC         ;CLEAR XON CHARACTER
EB55 85 FD              STA $FD         ;CLEAR XOFF CHARACTER
EB57 60                 RTS
```

Past and Present

Commodore's history is a fascinating story of depression and elation. Where did it come from and where is CBM now?

by Norman Doyle

The story of Commodore's rise is a typical American rags to riches tale, a story which is inextricably linked with the fortunes of Jack Tramiel, the company's founder. Computers came late in the development of the company starting with the PET series and currently scaling the heights with the new Amiga range.

During the War, Tramiel lived in Nazi occupied Poland where he was subjected to the suffering associated with being a Jew under Hitler's reign of terror. When liberation came it meant a new life for Tramiel in his adopted country, the USA.

After a time as a taxi driver, Tramiel joined the US Army where he was in charge of Army office equipment maintenance in New York. Hardly a hazardous occupation but one which was to set him on his way to a fortune back on civvy street.

Typewriter maintenance became his career and soon he was able to form his own company in Toronto. This was back in 1958 and the Commodore Typewriter Company's first product was the Everest typewriter. The shape of things to come started to form in 1961 when Japanese-made mechanical adding machines were added to the range. The firm expanded through the Sixties encompassing all forms of office furniture and equipment. The rapid growth was followed by an equally rapid decline and in 1965 it would have vanished completely but for the intervention of an enterprising financier.

When Irving Gould stepped in with the much needed cash, he started a new phase of growth for Commodore which saw the introduction of electronic pocket calculators in 1969. The C108 calculator sold for just under £200, a phenomenal price by today's standards but a relative cheapie in the early Seventies.

The middle of the decade saw Commodore in trouble once more. Suddenly chip prices fell from £12 to £1 and the calculator price wars began. Commodore found itself sitting on a pile of devalued chips and eventual bankruptcy once more stared Tramiel in the face. The problem was exacerbated when the chip supply dryed up after Texas Instruments decided to switch from chip manufacture to calculator production. Tramiel is known for not doing anything by halves and his solution was to buy out small companies which produced the raw materials and components for his new range of machines.

Tramiel's decision brought 22 lawsuits from companies which he had contracted to supply his needs. Miraculously none of these suits succeeded and CBM was on its way to the top.

Fortuitously, one of Commodore's acquisitions in 1976 was MOS Technology which was developing a new microchip called the MOS 6502. Another side benefit was in the person of Chuck Peddle whose vision of computers for the home planted the seed for Commodore's future development.

There followed a short flirtation with the hobbyist market with the production of the KIM, a single board kit based around the 6502. Shortly after this the first PET appeared. Originally destined for a leather goods company which was breaking into the electronics market, the PET was turned down by Tandy's in favour of another machine which became the TRS80 computer.

Tramiel decided to take on the PET even though he now considered Commodore's prime business to be component manufacture. At the time his main aim seemed to be recouping a potential loss from the development of the machine. Any qualms which he may have had were dispelled after the 1977 Consumer Electronics Show in Chicago when the Pet attracted £3 million worth of orders within two months. Commodore had had entered the big league.

The first PET was an inelegant beast with built-in 40 column screen, cassette recorder and a mini 8K memory. Though pathetic by modern standards this was low-cost hi-tech and more and more American families decided it was a really neat addition to there home furniture.

1978 saw sales increase and Commodore saw itself more and more as a computer company rather than a pure component manufacturer. In 1979 Japanese disk drives and printers were added to the Commodore range and 1980 saw the appearance of the 4000 and 8000 series machines.

Also in 1980 the first of Commodore's mega selling computers hit the streets. The VIC20 was cheap and colourful and captured the imagination of the home market. It's eight colours and 22 column by 24 line screen display with 3.5K of RAM was soon surpassed in this country by the Sinclair Spectrum but not before the VIC had established Commodore as a major force in the home computer market.

Since then Commodore has had a chequered history. The continuing popularity of the VIC's successor, the Commodore 64, has been tempered by a string of less notable machines. Tramiel's tempestuous departure from Commodore leading to his take over of rival company Atari has added to Commodore's worries. Extensive Government and European loans to finance the setting up of a factory at Corby were counteracted by market forces which caused the works to be closed down only a few years after it opened.

Commodore now seem to be back on the road to total recovery and a lot of their future hopes are pinned on the Amiga, a project instigated during Tramiel's reign and now being shadowed by Atari's ST machines. Yes, Jack Tramiel has had a lot to do with Commodore's fortunes!

Red Boxes

Now there's a home control system available for the C64, which will switch on the kettle and the telly or even warn of intruders.

By Mycroftt Appleby

Home control has always been promoted as one of the major uses of computers in the coming years. However, in the past home control systems were expensive, difficult to use, and were only available on micros with good, complex interfacing systems like the BBC Micro. More common computers like the Commodore 64 were not really used at all. One unbuffered user port that doubled as an RS232, and an obscure custom serial system, isn't really the stuff that interfacing dreams are made of.

Finally, there is now on the market an easy to use home control system that is available across a range of micros including the Commodore 64. The starter pack for *Red Boxes* comprises the main controller — called 'Red Leader', and two control units — an infra-red detector (red two) and a plug actuator (red one). The concept behind the *Red Boxes* is the controller unit 'talking' to all the other units via a modulated serial link via the mains.

Red Leader is a computer in itself. Comprising a 6502 derivative processor just like the C64, 8K of RAM, and a BBC-like control Basic. The Commodore 64 connects to this and is used as a terminal. The way this is done is extremely clever. A wire is connected on the C64. Press 'Run/Stop' and the Red Leader behaves just like a cassette player, sending cassette-type signals to the Commodore 64.

After a short time the terminal program is loaded into the computer and the link between the Red Leader and the Commodore 64 turns into a proper two-way serial link. You will then drop into the control program mode.

This mode is the simplest operating method on the *Red Boxes* system (the other being Red Basic, but more of that later). You are presented with a menu where you can log-on devices (i.e. tell Red Leader that they exist) type in their code addresses, turn them on or off and set them up to turn on or off at specific times. You can even relate the input of one to the output of another so that a movement on the infra-red detector will activate an alarm for instance.

This program, whilst being extremely simple, is also quite powerful and lets you perform all the major actions that you would want to in a quick and easy manner. However for complex, multi-unit, interaction you need to get down to some planning and programming. For this you need to use Red Basic and probably need to get hold of the Projects Manual (good value at £9).

Documentation

The manual supplied gives you some simple information on the Basic, but is really aimed at tbe inexperienced user so goes into more detail about the menu program. The Projects Manual on the other hand, is one of the better tomes that I have read. Going into enough detail for the experienced programmer out to do something really flashy, or the beginner who is au fait with Commodore Basic and wants to get down to using Red Basic.

If you have ever used a BBC micro you will be immediately used to Red Basic as Red Basic is a subset of BBC Basic, with a lot of extra commands added to handle the control aspect of the system. If you think that Red Basic being the same as BBC Basic is a little strange, then you won't when you hear about the Founder of General Information Systems (the people who make Red Boxes). Chris Curry (for it is he) started Acorn many years ago and this is one of the first projects that he has embarked on since the Acorn shake up.

As well as most of the BBC Basic commands and instructions — which includes most of the structured programming aids (repeat, gosub name, long variable names etc.) there are commands to log-on devices and manipulate them. As this Basic is a lot more advanced than the Commodore 64 Basic, you should have no trouble at all in telling units to do whatever you want, especially with the real-time commands. These are commands that are very similar to some commands on the Amstrad. Sections of program are executed when an external device instructs them. So if the timer section of your program is controlling the heating and a burglar trips the infra-red motion detector then the 'alarm' section of your program can be activated.

8K may not sound like a lot, but try and think of the last time that you wrote a program that was actually 8K in length. Remember, you don't have to worry about screen or colour memory, or sprites, or sound. The Commodore 64 handles all of that. And if Basic is a bit tight you can

always switch to machine code.

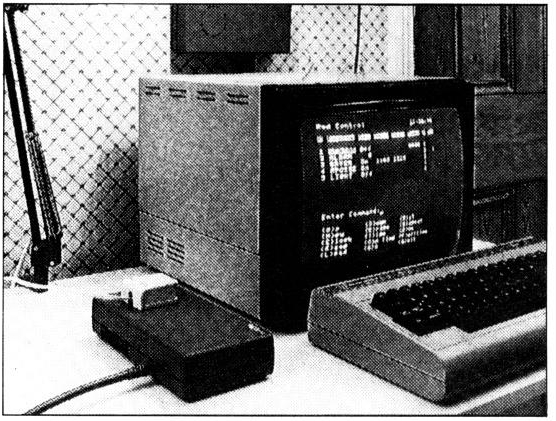
The Red Leader uses a 6502 processor, and you can program it in machine code by pokeing code into memory and then executing it. The Projects manual carrys a list of operating system functions which are very similar in a lot of ways to the Commodore Kernal system. The Basic has the same memory management aids as the original BBC Basic with pseudo-variables like Page and Top to indicate when the Basic program is going to sit, and Lomem and Himem to reserve space for the machine code area. The operating system and memory areas are also very similar to the BBC, even down to where the system memory ends.

The Basic can also save any programs written under it to a tape connected to the Commodore 64. To do this, the Red Leader first transfers the contents of its memory to the C64. You must then disconnect Red Leader and connect up a tape recorder, and write to tape. Then re-connect everything up.

The main plugs of this system is that when you have a program debugged and working to your satisfaction, you can unplug the Commodore 64 from Red Leader completely and use it for something else or whatever. Yet, Red Leader will just sit there executing your program forever. However, you can leave your Commodore 64 connected if you want to — if you need to see information displayed on the screen for instance — though the power consumption over a period of time would be offputting. The Red Leader on its own uses up very little power, and it is feasible to leave it switched on all the time.

Reds One and Two

The two units supplied with the starter pack are Red One and Red Two (sounds a bit like something out of Apocalypse Now). Red One is the actuator. This is a unit that plugs into the mains at one end and then has a mains socket at the other. Anything you like can be connected to this and turned on and off from Red Leader. There is also a manual override on the unit to toggle it on and off as you see



fit. An LED on the box tells you whether it is on or off.

Red Two is an infra-red motion detector. One end plugs into the mains (as usual) and at the other end is a small box about half the size of Red One and Red Leader. In this is a large window. If anything that is at a different temperature than the surrounding air moves within 16 feet of it then a signal is sent back to Red Leader.

All three units come with wall mounting brackets with all screws and Rawlplugs, though they don't need to be wall mounted, it is excellent that these are included. The cables are also very long, over six feet in most cases. This is just about the right length. Usually on systems such as these the cables are not quite long enough. I think that they got it right this time.

In the near future GIS will be releasing an alarm unit and an analog input unit. These will allow you to build up an alarm system more easily or control a thermostat for heating. Next in line are temperature probes and an RS232 link.

This last unit will allow your computer to talk to a printer in another room, or even another building, by sending its information down the mains line. This could also be used in networking computers in a simple and easy manner.

If anyone is worrying about the mains system, don't. It is perfectly safe and very well worked out. Each unit has its own unique serial number and the Red Leader has to know what it is. So whilst you could control your next door neighbour's heating system, you'd have to know his encryption code first. However, if you wanted to communicate with a friend down the road, as long as you were on the same local ring main, and within a few hundred yards, you could do it.

Verdict

On the whole this is a brilliant system. One of my main interests in computers is in the field of real event control. And this is the easiest to use, safest, and most well thought out system that I have ever seen. This only obstacles in its path are public resistance to this sort of thing, and the price which, though low for a control system, is still high for the average Commodore owner. I will watch this with interest.

Touchline

Company: *General Information Systems, 1 White Hart Yard, London SE1 1NX.* ***Price:*** *£129 (starter pack).*

Spanner in the Works

If you rely heavily on your computer for business or leisure activities, then a breakdown can be infuriating. Here are a few tips on simple fault finding and repairs.

By Mike Roberts

The entire range of Commodore computers set high standards in design, production and reliability.

All the hardware is built up to a specification rather down to a price, unlike one or two of its competitors.

Opening up any Commodore computer will show a large number of integrated circuits which are the chips that make the computer work. However, they are usually the first items to produce problems when anything serious malfunctions in your computer.

There can be other reasons for your machine's failure, and many are serious. If your guarantee has expired, you may be faced with a hefty bill.

However, all is not lost. You can usually trace the cause of a breakdown to one or more of the ICs. Replace the chip, and the problem is solved.

Following a simple check list, can save pounds when it comes to repairs.

Your Options

Imagine a nightmare situation. You set up your C64, plug everything in, and connect the screen turn it all on, and nothing! The screen is blank and the keyboard dead.

What can you do?

Firstly, you should check the LED on the top of the machine. If this is off then the power supply has probably blown. This is the only situation (excepting the unlikely event of the LED failing) in which the LED will not light up. If the LED is alright, then you must test the computer.

Going Inside

First, connect a tape deck, insert a tape in the usual manner, and press shift-run/stop. If the tape is dead then so is the computer.

The next step is to check the internals of the machine. Remember that the LED power is tapped from the supply before the fuse. The computer takes its power after the fuse. So this is the first thing that must be checked. If it has blown then you've located the problem, and you can fix it quite simply.

The fuse only costs a few pence and is of the type BEL 3AG, one amp 250V. It is located on the right hand side near the power socket close to the regulating and rectifying circuitry. If the fuse is whole, then the only other explanation is that a section of this circuitry is blown. But this is rare, and you would usually see the damage as blackened fused components. If this is the case then you need professional help.

Chip Testing

If the computer is just behaving oddly then you need to ascertain which chip is causing the trouble. A lack of screen display usually means that the video output circuitry has blown, as this involves a lot of discrete components. You will also need professional help for this. The chip can be tested by plugging it into a friend's C64 to see if the same problem re-occurs.

This technique of using another C64 to test chips is relatively safe, but be careful not to force chips or bend pins. Make sure you earth your hands by touching something metal before handling any components.

If your video circuitry is OK then

any other problem will generate a screen display from which you may be able to diagnose a fault.

Junk on the screen with a regular pattern and an underlying picture of the correct display indicates a RAM problem. Professional service again I'm afraid.

Absolute silence obviously indicates a dead sound chip. The sound circuitry is very robust, and it is usually the chip that is the first to go.

If the ROMs fail, then you will be left with a blank screen. Although this is very unlikely as these are amongst the most reliable chips in the machine. A dead processor will also exhibit symptoms similar to this.

The remaining main chips are the I/0 6569 type. There are two types of these, U1 handles the keyboards and joysticks. Junk being typed out on the screen as soon as you turn it on, or a dead keyboard, indicates either a fault with this chip or its support circuitry. Alternatively, older machines may have their keyboards full of dust. Cleaning will solve the problem.

The other chip, U2, handles most of the main I/O with the user port and series I/O.

The problem here is that it is difficult to distinguish whether the fault lies with the chip at U2 or the device currently in use e.g. the disk drive.

Summing Up

If you follow these simple tips you may be able to rectify a small fault yourself, or at least have some idea of what has malfunctioned.

If the fault is more complex, you need to find a good repair shop. In this case, it is better to use a larger organisation rather than a one horse outfit, and preferably one that specialises in Commodore computers.

Repairs Touchline
I. Bateman: Tel: *0536 69454 (phone only).*
MCE Services: *Glyn Spencer, 33 Albert Street, Mansfield, Notts NG18 1E.* ***Tel:*** *0623 31202.*
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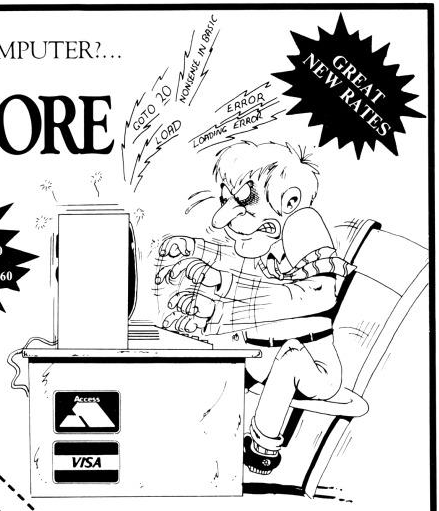

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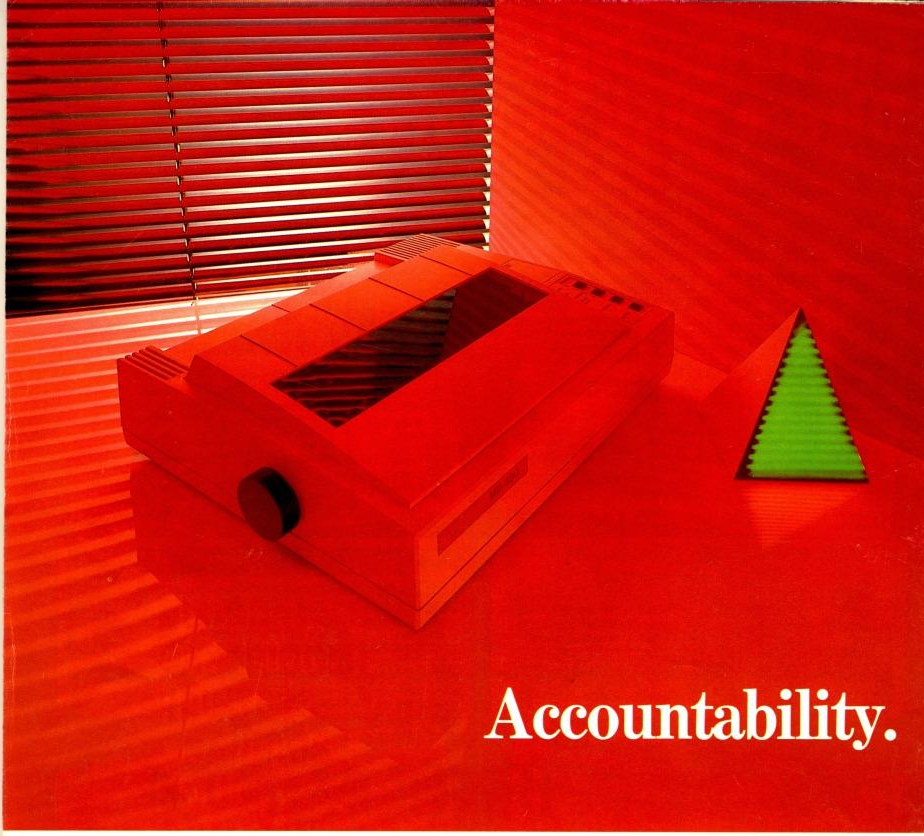

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